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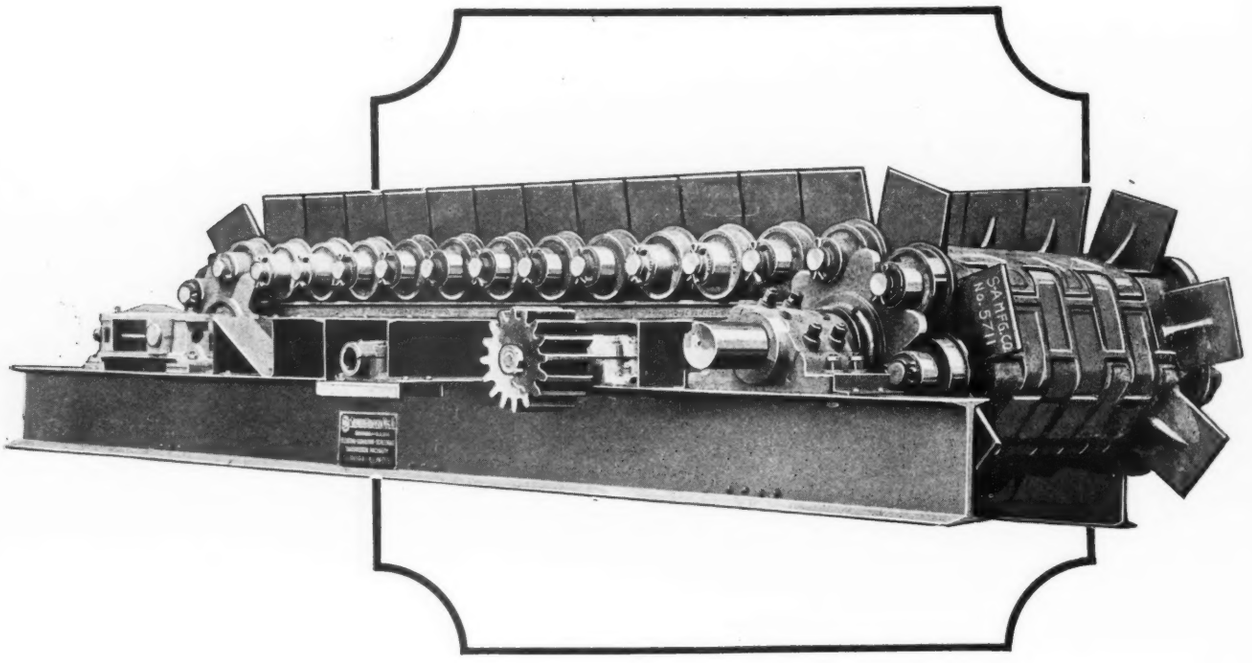
A WEEKLY JOURNAL REPRESENTING THE WORLD'S MINING AND METAL INDUSTRIES

March 17, 1923



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ENGINEERING & MINING
JOURNAL-PRESS
J. E. SPURR, Editor

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Federal Executive Reorganization

REORGANIZATION of the federal departments, a favorite subject for discussion and endeavor during the last five years, is progressing actively at a rate which does not promise completion within any visualizable period. After some years, the chairman of the joint committee selected by Congress and the President for the purpose has a plan of rearrangement, and this plan has been published in the form of a letter from President Harding to the chairman. It is hardly necessary to comment now on the features of the plan, which represents what the President will approve of and what the various heads of executive departments have agreed upon. But the fact that the reorganization has been worked out and made public without consulting the commission (except the chairman) as to their opinion, does not suggest any certainty of the commission as a whole approving it in a hurry, if at all. Nor does it suggest that Congress, which appointed its representatives on the commission, will hesitate to oppose and modify—in fact, to take plenty of time in demolishing and rebuilding the plan of reorganization when and if it gets ready to consider the problem.

The political exigencies will govern this in large measure. What political capital can Congress make out of a reorganization of federal bureaus—if any? The ship of the campaign for a Department of Public Works seems to have foundered among the executive shoals and to have sunk to the deeper regions of the ocean. The plan which has just been suggested by the chairman of the commission does not provide for any such department, although it provides for an assistant Secretary for Public Works in the Interior Department. But this is not much more than a name, since many of the engineering activities remain in other departments—such, for example, as the Coast and Geodetic Survey, which remains in the Department of Commerce. The proposal for a Department of Mines, quiescent but not abandoned, will probably be brought forth as one of the contending proposals if and when reorganization comes up before Congress for debate.

As to the plans suggested, the Bureau of Mines is moved to the Department of Commerce, but the Geological Survey stays in the Interior Department. But the mineral production statistics of the Geological Survey go to the Commerce Department. Why the Bureau of Mines should go to the Commerce Department but not its sister bureau, the Geological Survey, is a fine point which we will not attempt to solve. Why the Commerce Department is ambitious to represent the mining industry but has kept its hands off the plant and animal industries can be answered only in terms of practical politics.

He who waits for government action in an important matter must be a good waiter and quenchless philosopher. That is why the average intelligent citizen wants to keep the government out of business so far as possible, because big affairs privately managed move more swiftly and efficiently.

Series or One-Stage Crushing in Ball Mills

ON ANOTHER PAGE of this issue we publish an article by Mr. John Herman on the theory of rock crushing, with particular reference to the laws of Kick and Rittinger. The conclusions are based on the result of a large number of tests in a ball mill provided with a peripheral screen, thus insuring the immediate discharge of material when ground fine enough. Mr. Herman's conclusions are instructive as well as interesting, especially when he discusses stage crushing. Ore dressers will recall the frequent disappointment that resulted with ball mills in which it was planned to reduce rock through a wide ratio of particle size; but it is well to remember that all the failures occurred with end-discharge mills. In such cases it was evident that some of the ore as it entered the mill was ground nearly fine enough; it was probably crushed to the desired size within the first twelve inches; but it could not escape until it had reached the other end of the mill, during the passing through which it was pulverized beyond the economic limit, thus hindering the efficient grinding of other, coarser particles. The result was a comparatively high power consumption for the amount of ore ground to the desired fineness.

With a peripheral-discharge mill, on the other hand, the ore particles are free to escape immediately after sufficient comminution has occurred, and so the reason can be appreciated why one-stage crushing is economical in a mill of this type with a ratio of reduction that would be impracticable with the trunnion-discharge mill.

Ball milling has gained favor so rapidly that practice has been influenced in many instances by catch phrases and an undue reliance on the advantage of simple and cheap design. Generalizations are inadvisable; they often lead to a condemnation of ball mills because of the failure of one or more particular types. Mr. Herman's conclusions on the scope of one-stage crushing within a wide range in a peripheral-discharge mill will serve to remind us that the old Krupp type of ball mill had several features that were based on sound reasoning and an appreciation of the fundamentals of ore-dressing practice.

The Advance in Copper Prices

THREE MONTHS AGO, when copper was selling at 14c. per lb., even the most optimistic did not predict that a price of 17c. would be reached early in March. For some months the copper surplus had been reported as approximately normal, and yet the price showed no marked upward trend. It was felt that even though a mild increase in demand came, production could well be increased to take care of it. But after the first of January the demand increased faster than was expected. The copper-consuming industries were assured of even more spring business than they had anticipated, and their orders soon absorbed the small amount of unsold copper in the market. The

producers, recognizing that the price of copper had long trailed in the dust compared with that of other commodities, were quick to advance quotations to more reasonable levels. The rapid price advance of course brought out some orders that would otherwise have waited, thus adding fuel to the flames.

Coupled with the increased domestic demand has been a better foreign enquiry, despite unsettled European conditions. In 1913 the United States exported an average of 77,000,000 lb. of copper per month. The 1922 average was about 60,000,000, but it is now probably nearer 75,000,000, or practically the pre-war figure. The potential foreign demand, when finances can be better arranged, is much greater than this.

So fast has the price advanced that it has not been possible to increase production to the extent that would naturally occur. Labor shortages and a none too prosperous condition of company treasuries have prevented producers from holding themselves in readiness for maximum production.

The comment around New York is not infrequent that copper prices have advanced too fast; that a reaction is bound to occur; that 17 or 18c. is an artificially inflated price; and that the use of substitutes will be promoted. We have little sympathy with these ideas. The advance in copper prices was long overdue, and even though it has been rapid it has been no less justified. It is unlikely that the gradual advance in production, which will of course be stimulated, will have the slightest tendency to flood the market for some time to come, or until American business conditions take a decided turn for the worse. Even then, increasing European demand may more than make up for the decrease in consumption here.

Compared with other commodities, copper is still much lower than it should be. Comparing 1913 and present prices, copper should now be 29c. per lb. to be on a parity with lead; 22c. to be on a parity with zinc; and 28c. to be equivalent to iron. According to Prof. Irving Fisher's price index based on 200 commodities, the 1913 dollar is now worth 60c. Copper should therefore be 25c. per lb. Plainly, 17c. is still cheap for copper.

There seems little foundation for the idea that copper prices approaching 20c. will encourage the use of substitutes. To begin with, the substitutes themselves have advanced. Aluminum, for example, which was 18c. per lb. last fall, is now 25c. But even so, the use of substitutes is not a practice that is embraced over night. Substitutes come into use only gradually and because the accustomed material is absolutely unprocurable, or has advanced to an unwarranted and long-continued high price level. Shop practice itself is difficult to change, and it takes time to educate consumers to new materials.

Everything points to the fact that the advance in copper price is a healthy one and that it will endure without, certainly, more than a minor reaction. The long-suffering copper-producing communities can easily stand the modest prosperity that 17c. copper can give them. Residents of Michigan, Montana, and the Southwest who depend on the copper industry have had two pretty lean years. The staffs of even those companies that have continued to operate have been cut to the bone, as have salaries and wages. Now conditions should rapidly improve. Some companies can make a lot of money with copper at 17c., and there are few operators that cannot at least under present conditions make a fair profit.

Linking North and South

ALTHOUGH Harriman predicted that trains would eventually run between New York and Buenos Aires, few outside of railway offices have considered the matter seriously, in the absence of pressing need. The water route has been the natural one, and for freight no other could be cheaper. But with rail communication will come a development of the countries to the south so great that it cannot be appraised.

In spite of our own experience, imagination can scarcely picture the results. A new effort in this direction is being made. Plans made by the Southern Pacific of Mexico over twenty years ago, but interrupted by revolution and disorder, are being carried out. Construction of a hundred-mile link between Tepic and La Quemada has been begun, and with its completion a new route will be opened for through trains from the border to Mexico City. Closer communication between the manufacturing, agricultural, and mining districts of the republic will be thus afforded.

Three years will be required to complete the work, and the cost will be between $8,000,000 and $10,000,000. Large though the cost be, the benefits that will be Mexico's will far exceed it.

Help From the Government

HOW MUCH should the government do for us? How far should it go in protecting and bettering us? The more dependent part of the population look to the government as the possible source of all future happiness and perfection, and berate it in the present as the cause of all their misfortunes; the aggressive man, who has circumstances and his destiny well in hand, and only asks not to have his game blocked, is quite in favor of a minimum of government activity.

The government management of the mail business and even the express (parcel post) business, and the business of common-school education, are examples of government activity which everybody approves. It is to be noted, however, that the first is interstate and therefore falls unavoidably to the lot of the federal government; while the latter is a local problem, and thus is not handled by the federal government, nor even by that of the state, but is conducted by the city or village government. This illustrates a principle of governmental management, that the costs of a given task are to be assessed directly against those persons benefited, in the form of taxes, and not be levied on one group for the benefit of another. This is a sound rule, to which unjustifiable exceptions are made when the majority taxes the minority, and on the principle that might is right and that makes it right. The income tax is an example of the majority taxing the minority simply because they have the power to do so. The income tax payer pays for benefits which are received by another who does not pay. Another example is the special legislation in favor of farmers, put through simply because of the numerical power of the farm bloc.

Such special legislation has been proposed for the benefit of the miner, and several plans are at present being pushed, one, for example, for a bounty on the mining of gold, another the upholding of the price of silver after the expiration of the Pittman Act. We ardently desire their success; but we do not anticipate it, because the numerical strength of the mining industries is not great enough to force taxation for their benefit upon the taxpayers of the country as a whole,

as the farmers and the great mass of the less prosperous have been able to accomplish.

The recent proposal that the federal government build a custom smelter in Alaska focused attention upon the problem from a more specific angle. This would be a step in the direction of socialistic activity for which there is probably no precedent in the United States. In Manitoba, however, for example, provincial grain elevators have been built for the benefit of the farmers and to encourage settling and planting. The Alaska proposal was gone into by government officials, and advised against—mainly, perhaps, because it was not considered that there would be enough ores delivered at the smelter to justify its building rather than from any profound examination into the principles involved. But in this case, the use of federal money for such an improvement would not be justifiable, because the funds would be mulcted from taxpayers who would derive no benefit therefrom. On the other hand, the establishment by the territory of aid to prospecting and mining in some form or other (which assistance might take the form of expert geological advice, examination of specimens, assaying, or even ore sampling and shipping facilities) lies in quite a different category; and if the people of the territory believe it will benefit them, they are entirely justified in investing their official funds in such ways.

As a rule, however, the less business which the government undertakes, the greater will be the prosperity of the people; for government business is apt to be loosely run, controlled by bureaucrats and politicians, and is usually conducted at a loss which is ceaselessly tapped from the pockets of the struggling and unaided taxpayer.

Criminal Stupidity

CIRCUMSTANCES surrounding the outbreak of fires in two different mines in the Coeur d'Alene district of Idaho lead the managers to suspect that they were not the result of accident. Apparently someone started them purposely. In the first the lives of three innocent workmen were sacrificed; in the second, fortunately, no fatalities are reported. Operations were suspended for many days in both instances, and financial loss was suffered by shareholders in the companies, by the business men of the community, and by a large number of miners who otherwise would have worked and drawn wages steadily. The miners, it is safe to say, could least afford to have their income curtailed.

It is not known for certain that these fires were of incendiary origin, but it is doubtful if the suggestion would have been made by responsible managers if there was not good reason to believe it true. It is well known that many mine fires have been started deliberately. Some have been started because of a personal grievance on the part of an individual employee. He feels he has been ill treated and he thinks that he will "get even" with the superintendent or with that impersonal thing "the company," by starting a fire. This is of course misguided revenge; it is criminal, but it is understandable.

A more vicious act is the starting of a fire as a measure of organized sabotage. The "radical" labor organizations like the I. W. W. and the One Big Union have for the foundation of their policy the idea that anything that will hurt Capital will benefit Labor. They teach that the "class war" is ceaseless; to keep from being ground under the heel of Money, the workers must continually assert themselves. Persistent sabotage lets the employer know that the labor leaders are alive. When wages and working conditions are satisfactory and there is no good excuse for a strike the leaders must do something to keep fresh the spirit of hatred among the workers, and among the employers, the knowledge that the war is still on. Astonishing as it may seem, fires have been started in mines for no other reason than this. Not only is it criminal—it is grossly stupid. Such lawless and repugnant acts hurt the capitalist much less than they do the cause of organized labor.

Safety First Vindicated

THOUSANDS saw a "stunt artist" fall to his death the other day in New York as he was scaling the front of a high building, a feat he had often done before, but this time to advertise "Safety Last," the latest screen comedy of a popular movie star. Although simply a business proposition to him, the stunt was essentially a mockery of the gospel of "Safety First," a gospel that is being broadcast, not to breed a race of mollycoddles, but to teach men to avoid disaster for themselves and their dependents by exercising greater caution.

The huge crowd that saw the accident received a lesson in what not to mock. Such performances could well be stopped as not conducive to the public welfare. Perhaps the "human fly," the reckless airman, and the like are simply the progenitors of a future race that evolution will produce to traverse space and scale the planets, but at present we are inclined to call them fools. Their counterparts are present in every camp—the smart alecks who flout the safety rules, and who remain a menace to themselves and their fellows until accident or discharge happily removes them from the scene. It ought not to be necessary to enact laws to prevent foolhardy adventurers from trying to get themselves killed; ample police power now exists to stop performances dangerous to the participants and demoralizing and degrading to spectators.

The Deepest Mine

THE DEEPEST MINE in the world is the St. John del Rey, in Brazil. It may interest our readers to know that recently it has attained a vertical depth of 6,726 ft., where the temperature of the rock is 117 deg. F., necessitating a system of artificial cooling on a large scale. This has proved successful, but the steplike series of shafts and levels by which the bottom stopes are reached has become so cumbersome as to involve an excessive cost in hoisting and ventilation. A more direct entry, by means of a vertical shaft, is being considered—belatedly, it would seem to a detached critic. It is pleasing to add that the veteran manager, Mr. George Chalmers, is able to say that the last year was the most successful in the company's history—at any rate since 1884, when the mine was a comparatively young prospect. Further, the ore in the bottom workings shows no signs of a decrease in gold content, so that the St. John del Rey constitutes a remarkable exception to the usual impoverishment of lodes in depth.

American Individualism

By T. A. Rickard

THE REVIEW of Mr. Hoover's essay on "American Individualism" by the editor of the *Journal-Press* recognizes the interest of the subject when discussed by so notable an exponent of the idea. It is fair to say that Mr. Hoover's career is a more eloquent expression of American individualism than his writing. No living American has better exemplified the fundamental concept of the Declaration of Independence. The idea itself is not new, but the people of the United States in their pursuit of the democratic ideal have applied it to fruitful purpose. We have practiced it; but as a theory it is as old as philosophy.

In Herbert Spencer's "Synthetic Philosophy" the student will find a clear statement of the vicissitudes of individualism as an element in sociology. At the beginning, in the jungle, individualism was restricted only by brute force; the first step toward civilization, which is the art of living in a community, was to curb the aggressiveness of the individual and discipline him for the benefit of the tribe. The perpetual interaction between the individual and the aggregate within the social structure restrained the egoism of primitive savagery for the common good, and developed the first notion of that altruism by which humanity has risen from an ape and tiger existence. Men learned to control their individualism for the sake of the tribal group, by joining in defence against other and inimical groups. Thus militarism suppressed individualism.

The first concern of the tribe or the state was self-preservation. Therefore individualism succumbed to regimentation. But when the life of the community was no longer menaced, this coercion of the individual became unnecessary. An industrial type of society was developed under the protecting wings of peace; the need for despotic control of the citizen diminished and his individuality was free to assert itself within the reasonable limits of the law, the chief function of which became to maintain "the conditions requisite for the highest individual life." The change from a militaristic to an industrial type of society was made sooner in America than elsewhere because our comparative isolation from Europe and the rapid development of our natural resources favored that evolution. The individual has ceased to exist for the State; the State exists for the individual; and he is given that equality of opportunity of which we boast as the glory of our democracy.

That idea was carried forward with each successive wave of migration, from the dawn of history, when the Asiatic hordes first moved westward, to our own day, when the pioneers of the West crossed the plains and founded the communities of the Pacific Coast. The democratic idea was ever that of the frontiersman; it was to fix the rules of the game fairly and by general consent, and then let the best man win. It characterized a community in which every adult man was an effective unit, able and willing to hunt, work, or fight for the group. Because he was willing and able to perform his part he was given a voice in the counsels of the group and ranked equally with his fellows. Every part of the United States went through the frontier experience, from the days of Daniel Boone to those of Kit Carson, and thereby recognized each man's claim to a personal stake in the game of life. With that privilege has come, or should come, as Mr. Hoover says, "the sense of duty as well as of a sense of right and citizenship." It is the mark of a civilized man to recognize that every civic privilege carries with it a corresponding duty.

The American ideal has been stated in eloquent words by another great American of our own generation, Walter H. Page: "The fundamental article in the creed of the American democracy—you may call it the fundamental dogma if you like—is the unchanging and unchangeable resolve that every human being shall have his opportunity for his utmost development—his chance to become and do the best that he can. Democracy is not only a system of government, it is a scheme of society." Page believed that the United States fulfilled this purpose more completely than any other country, and Mr. Hoover agrees with him. The late Ambassador to England cited the seven million farms of small size, tilled by the owners themselves, as the best exhibit for our democratic institutions. The former Food Administrator says: "Individualism has been the primary force of American civilization for three centuries. It is our sort of individualism that has supplied the motivation of America's political, economic, and spiritual institutions in all these years. It has proved its ability to develop its institutions with the changing scene. Our very form of government is the product of the individualism of our people, the demand for an equal opportunity, for a fair chance."

We are a nation of optimists, as the stock exchanges testify at this time, when much of the world is in travail and trouble; so we are ready to applaud the insistent hopefulness of a man who typifies the triumph of his own creed of individualism, but no cool spectator can fail to see that self-assertiveness today, as in the paleolithic past, is dangerous to human welfare. Every economist recognizes that danger. John Stuart Mill saw how the real freedom of the citizen was imperilled by an excess of individualism.

We may pride ourselves on having discarded the militaristic regimentation of the European system, but have we not established an industrial regimentation in its place? The subservience of the individual laborer to his union, which is controlled by a few aggressive leaders, is as much counter to our American ideal as is the surrender of the individual employer to the corporation, and of the individual corporation to the "trust," which marks the complete subservience of the individual to the machinery of a system. Bigness has become our fetish and super-organization the god of our idolatry. The concentration of certain branches of trade in the hands of a few predatory speculators and the control of organized labor by a few unscrupulous demagogues present phases of our social development that should make us pause in our self-congratulation.

The submergence of the individual, the disheartening of competition, and the killing of initiative by the crass power of capital are symptoms of a departure from our ideal. We cherish that ideal and hope to attain it, but it is much too early to lay claim to a complete fulfilment. We shall be more likely to consummate our purpose if we abstain from premature felicitations and recognize how much remains to be done before the ideal becomes a reality.

DISCUSSION

The Prospector

THE EDITOR:

Sir—What has become of the prospector? This is a remark frequently made by old-timers, who claim that in the old days nearly every man in a mining camp was a prospector and willing to sacrifice a certain percentage of his time in roaming the hills in search of wealth, while at present the prospector, like the buffalo, has become wellnigh extinct. The disappearance of the prospector is a subject thrashed out at nearly every mining convention. Governments in various ways have been devising schemes for luring the prospector back to the hills, but with practically no success.

There is some reason for this apathy on the part of eligible prospectors that cannot be attributed to decadence, lack of ambition, or diminished virility on the part of the present generation of prospectors. There may be a combination of causes, but prospectors themselves claim that the chief cause is the difficulty in realizing any real cash on a prospect once they get it. In the old days a promising prospect was always good for a certain cash remuneration. Men enthused, and without enthusiasm there can be little progress in mining. A promising discovery caused sufficient excitement to attract buyers who were willing to gamble something on the prospector as well as develop the property. One prospector receiving a small cash consideration inspired dozens of others, and as a consequence an army of prospectors roamed the hills. As was natural, some of these prospects proved to be mines, and, of course, many of them were failures, but since the old days a new system has evolved, whether to the advantage or disadvantage of mining is a debatable question.

In the old days the promoter, full of pep, sometimes scrupulous, sometimes the reverse, but as a rule a man of vision, with plenty of enthusiasm and indefatigable energy, was the medium that came between the prospector and investor. It must be admitted that a certain percentage of fraudulent promotions were allowed to go unchecked, but even today fraudulent promotions are not altogether eliminated. But it seems to the prospector of the present day that modern mining has gone to the other extreme. The promoters of the old days have been superseded by the geologist and mining engineer. Though the prospector recognizes the superior qualities of these trained experts, and receives from them many valuable hints, he recognizes also the many obstacles that are thrown in the way of marketing his prospect. Undoubtedly many members of the profession possess commercial minds as well as technical training, but the prospector, whether justly or otherwise I do not care to say, sizes them up as merely negative, lacking in imagination, optimism, timid as to their regulation, so that unless a prospect has all the earmarks of a sure thing they report unfavorably, and even under favorable circumstances they prefer to report from a purely technical standpoint, which often leaves the prospector as well as the investor at sea as to the commercial possibilities of the property. These negative reports are not conducive to good salesmanship, whether applied to mining or to other enterprises. The successful salesman realizes the necessity of displaying the bright side in order to do business. The investor argues the fairness of placing his capital for development, as an investment against the prospector's claim, without paying anything to the prospector, until the prospect is proved. This may seem logical from the investor's point of view, but it is the kind of logic that has driven the prospector out of business. This process of elimination has made it possible only for the prospector who has discovered a great mine to share in any remuneration, and real dividend-paying mines are rare in proportion to the number of prospectors, rare as they are today.

It is not unfair to say that not one prospector in fifty strikes a real mine. This makes the prospector's chance not fifty-fifty, which the ordinary gambler asks for, but one chance in fifty. "Blue-sky" laws are passed in Canada as well as in the States to protect investors from making a fifty-to-one shot. As a rule when a company is incorporated to place shares on the market to develop a prospect, if the proposition has not all the earmarks of success, as determined by a mining engineer, editors, mining engineers, and men of high repute consider they are working in the public interest by launching a campaign of denunciation, because a promoter is attempting to unload on the investing public a proposition that has not more than a chance in fifty of success. But these very same individuals or those who denounce the possible wildcatter consider it legitimate to devise schemes to induce the prospector to return to the hills and to take fifty-to-one chance so that mining may be kept alive.

Is it fair to expect a prospector to take a risk that would not be considered by the rasher investor? Is not the prospector as human and entitled to the same consideration as investors interested in other enterprises? The large or small investor usually risks only a part of his surplus, while his home comforts are rarely interfered with. The prospector not only risks his capital, but spends the best years of his life away from the comforts of civilization, an exile in an untrodden wilderness, a martyr to the insects, battling the elements, exposed to the Arctic winter, or the desert sun, pursuing his objective, a chance in fifty. The mining engineer would be considered indiscreet who would advise his company to take a fifty-to-one chance in developing a prospect.

The government of British Columbia has been devising various schemes to assist the prospector, and thereby to stimulate mining in the province. One scheme is to create a fund for sending out prospectors on a part-wage basis or of outfitting them. But prospectors cannot be sent out indiscriminately. A prospector without the aptitude has about as much chance of success as a man lacking the needed aptitude in any other busi-

ness. A prospector does not require a fifty-fifty chance, but, with a reasonable chance of success, the instinctive or born prospector will return to the hills—not that he is not conscious of the odds against him, but partly for his love of adventure. Inspired by an abnormal faculty that attracts men forward and drives away despair under most adverse conditions, they "hope." Moneyed men are generally accredited with long-sightedness and of having vision to comprehend the indirect profit not visible often to the man who works with his hands, but sometimes long-sighted men prove their short-sightedness by driving too close a bargain.

Increase the number of prospectors and mining prospers; discourage the prospector and the reverse happens. It is true that the men with the money have the whip hand, but by using it too strongly they are defeating their own ends by driving the prospector out of the game.

THOMAS A. BLAIR.

Barkerville, Cariboo, B. C.

Blue-Rock Phosphate in Tennessee

THE EDITOR:

Sir—Apropos of Richard W. Smith's article in your issue of Feb. 3 entitled "Mining and Washing Phosphate Rock in Tennessee," I desire to place before your readers some information concerning "blue-rock" phosphate:

Blue rock is found in ledges like coal and can be mined in any kind of weather, and when extracted can either be ground or shipped at once, whereas brown rock is found in pockets and is dug out of the ground like potatoes, and must then be washed thoroughly and dried before being ground. In one property near Mount Pleasant, Tenn., there is a bed of blue phosphate 30 in. thick. The bed lies on limestone and is overlain by slate. There was mined and shipped in 1921 from this property seven carloads of blue rock which averaged 72.20 per cent bone phosphate of lime and 3.46 per cent iron and aluminum. Since then there has been mined and shipped several hundred cars of blue-rock phosphate averaging over 72 per cent bone phosphate of lime.

W. N. HUGHES.

Nashville, Tenn.

Manganese Deposits in Nova Scotia

THE EDITOR:

Sir—The Feb. 17 issue of the *Journal-Press* contains a discussion by J. A. Reid, of Cobalt, Ont., of my article of Jan. 6 on the genesis of the manganese deposits of Lunenburg County, Nova Scotia. In order to tie in this letter with Mr. Reid's remarks, it is necessary to recite portions of the article in question as summarized by Mr. Reid:

> "The deposits are described as occurring in fissures in granite. The ore ends abruptly at water level and consists of pyrolusite and manganite with varying quantities of iron oxide. Calcite is an important constituent and tends to increase in quantity toward the borders of the orebodies."

Mr. Reid therefore concludes that in all probability the barren and deeper parts of the veins are mainly composed of this material. A considerable part of the calcite is manganiferous, as, according to the author's own statement, it carries from 0.5 to 3 per cent manganese.

In my article it was concluded that the manganese was originally derived from formerly overlying Carboniferous sediments, long ago removed by erosion, and that downward percolating waters had been the active agents in the matter. It is to this conclusion that Mr. Reid objects, and he suggests that the *ores* were due to the oxidation *in situ* of manganiferous calcite veins, which had previously been formed by processes analogous with those which operated to form manganese minerals at Leadville, Colo., and Butte, Mont., with which I happen to be slightly familiar. Mr. Reid's views do not diverge very materially from mine as to the manner in which the *ores* were formed, but it was found impossible, unfortunately, to hold to his views as to the origin of the "protore," which I wish to explain:

In the first place Mr. Reid should not assume that in all probability the barren and deeper parts of the deposit are composed mainly of calcite, because the illustrations, as well as the text of the article, plainly emphasized the fact that *only a few feet below* the general ore zone, the fissures contained "granite, very little altered," only the feldspars being slightly attacked, while the biotite remained fresh and brilliant. In fact calcite, oxide of iron, manganese oxides, and every one of the vein minerals disappear almost as abruptly as does the pay ore. There is absolutely no evidence of any primary, "protore" fissure-filling of deep-seated origin that might have been compared with some of the Leadville and Butte occurrences.

Let us now consider the mineralogical similarities: It cannot be gainsaid, I should think, that the manganese at Butte and at Leadville is closely associated with important igneous activity, and that the veins and ore deposits display a large and varied assortment of minerals that are commonly, and of necessity, to be expected in deposits of deep-seated magmatic origin. At the latter camp the remarkable thing is the absence of rhodonite and rhodochrosite—which are more or less prominent at Butte—and the fact that, as P. Argall has shown, the origin of the manganese found in the oxide zone is a manganiferous siderite found in the unoxidized zone, which is there quite abundant in irregular masses as limestone replacements.

In short, if we are to draw the conclusion that the Nova Scotia manganese had an origin similar to the manganese of Butte or Leadville, it is necessary to assume that it came, to begin with, from the deep-seated basal portion of the Nova Scotia biotite granite, and then, like Butte and Leadville, we would expect the Nova Scotia vein material to show the following characteristics:

1. The Nova Scotia deposits would include among their primary constituents one or more minerals containing considerably more manganese than the biotite of the granite, the latter being the *only* primary mineral in that region that is known to contain any manganese. As a matter of fact, in all the vein samples tested this class of material was found to contain less than half as much manganese.

2. Although ore solutions of magmatic origin might have formed calcite at Nova Scotia, such solutions would almost certainly have been highly siliceous and therefore would have produced considerable quartz as a primary vein mineral. As a matter of fact, although the samples show that the vein material contains a little quartz, it is present only as a secondary constituent, and is distinctly later even than calcite. Even the calcite is often later than the iron oxides.

3. Such solutions would undoubtedly have produced

sulphides, as sulphides are known in the Nova Scotia granite near the fissures, but, as a matter of fact, no sulphides are known in the vein matter.

4. Such solutions would probably produce a considerable variety of minerals at Nova Scotia, including silicates, and compounds containing volatile mineralizers. As a matter of fact the primary vein material is singularly simple in composition, consisting only of calcite, with small amounts of iron and manganese.

5. Such solutions, had they been active within the Nova Scotia fissures, would undoubtedly have altered the walls to considerable depths. As a matter of fact, all the evidence shows that alteration becomes rapidly less away from the surface. In the bottom of the shafts there is nothing but hard and only partly altered granite, only the feldspars being somewhat affected and the biotite remaining fresh and lustrous.

It is still possible that the "protore" might have been derived from deep-seated sources by "lateral secretion" —that is by surface waters which reached considerable depth, traveled laterally, and finally came up along the fissures, there depositing substances dissolved out from the rocks along their previous path—in this case, the biotite granite—and in such an event we would expect the Nova Scotia occurrences to show the following:

1. Some calcite might have been formed, but the veins would almost certainly be highly siliceous, which is notably not the fact.

2. Sulphide would be expected in the vein filling, but none has been found.

3. The vein filling would be composed of a considerable variety of minerals, including the manganese silicate, rhodonite. But the fact is that the vein filling is extraordinarily simple in composition, consisting only of calcite with small amounts of iron and manganese.

4. Such solutions would have to obtain their manganese from the Nova Scotia biotite granite, through which they traveled. As a matter of fact, the granite does not show any evidence whatever of loss of manganese, but on the contrary it contains today an amount which, though very variable, averages 22 per cent compared with 13 per cent in the average granite. These variations, moreover, are notable near the present surface: the sample from the bottom of the shaft previously mentioned contains the same amount of manganese as average granite, and this despite the fact that it came from within the fissure and was therefore in the path of any upward-moving solutions.

In short, the vein filling shows none of the mineral associations characteristic of the Leadville and Butte ore zones, nor do the walls themselves display analogous alteration, going to great depths. Even the calcite at the Lunenburg deposits is secondary, and there is evidence that perhaps its contained manganese may have been introduced in large part at a somewhat still later date. Certainly, it is not a type of deposit that has ever been deeply buried, in the form of a body of manganiferous calcite as suggested by Mr. Reid. This fact was brought out in my article, in the final paragraph at the bottom of page 12, where the gist of this letter was set forth in condensed form. In seeking for light on scientific subjects such as geology, it is dangerous, it seems to me, to skim over the hard facts in order to reach a conclusion in line with conditions *elsewhere*. Even the "runny" nature of some of the ground which Mr. Reid mentions and infers to be evidence of mineralizer activity, is, as a matter of fact, due to hydration, upon the opening of the rocks to the air, and to the naturally markedly porous condition of the ore itself in some localities. The evidence also points to the existence of ore in pre-glacial times. Some of it was eroded away by the ice, but the fact that some remains today, and the further fact that the mineralogic and petrographic evidence is so strongly against any deep-seated origin of the "protore," denotes that in this region the ice erosion was not sufficient to destroy the deposit, comparatively shallow though it must have been. There is an explanation of how this may have come about, but the evidence would be out of place here.

The original source of the manganese content of the fissures cannot be found in the granite at any geologic period. It must be sought in younger rocks, and of these, as explained in my article, the Carboniferous sediments are the most likely, in my opinion. They have long ago been completely removed by erosion from the region of the manganese fissures, thereby cutting off the supply of manganese. Today the deposits are in an advanced stage of geologic—and in all probability of economic—decadence. FREDERICK C. FEARING.

Philadelphia, Pa.

Vicissitudes of Silver Mining at Newburyport, Mass.

THE EDITOR:

Sir—The following information regarding a peculiar mineralized district, situated in a most peculiar part of the world, may interest some of your readers.

Mining and religion, both speculations, ought to travel well, one with the other; but seemingly they do not, but some of the mining public may have contributed to the million dollars smelted out of the public's pocketbook by a minister named Russel Conwall, through his famous lecture, "An Acre of Diamonds." One of the principal stories told in the original lecture concerned a young man who had graduated from one of the finest mining schools in America. This young man persuaded his widowed mother to sell her farm in Newbury, Mass., so he could go to the mining west and make a fortune and a name for himself. To the young man there was no ore in Newbury. All of it was in the West. But the man who bought the farm found nuggets of silver in the very rocks of the stone wall the youth had been seated upon. The man who used his eyes found the silver and made a fortune opening the silver mines of Newbury, while the educated youth, trained for a mining expert, gave away a fortune.

This story is wonderfully illustrative of a false kind of education so common these days, but the real history of the finding of silver in Newbury has to be recorded somewhat differently. No one made any fortune from Newbury silver, excepting the first original miner, Albert Adams, and the farmers of Newbury who were offered huge sums of money for their rock-filled worthless pasture lands and who were wise enough to accept the bounty fate offered them on a silver platter. The real-estate men may have made a dollar also, but fortunes were lost mining for the ore, and many poor people lost what they could ill afford to lose, although the worst losers were rich New Yorkers. Here is the true story:

Edward Rogers, in 1872, found a large piece of galena ore turned up with the earth at the side of the hole of some burrowing animal, while passing through the pasture of Richard Jaques. Rogers was a hunter, and a poor man, and he gave this piece of ore to his friend and neighbor, Albert Adams, who was then a

farmer by occupation. Adams took the piece of ore into Newburyport to a chemist, Karl Kastelhun, a German graduate from one of the great German universities. This chemist told Mr. Adams that the piece of mineral was galena, containing lead and probably some silver. Two years later the chemist determined the number of ounces of silver in that particular piece. At that time, 1874, Adams bought this pasture of twelve acres from Jaques, paying the ordinary price usually paid for pasture land. But the next year, 1875, Richard Jaques hired lawyers and had the courts issue injunctions against the mine, which were only removed after Jaques had been paid $25,000 cash for his twelve acres and the lawyers had been paid their big demands. The case was settled on the ground that Adams knew the land contained ore before he bought it for pasture land.

Albert Adams opened up the ground himself, in 1874, and the size of the mineral vein and its dimensions, which could easily be seen at the surface, brought all kinds of mining adventurers into the little farming town of Newbury. This original find was sold and resold, combined with a neighboring property, organized into one company and then into another company; and, first known as the Chipman mine, it has been better known as the Merrimac mine. It was reopened in 1919.

Hundreds of holes were blasted out in Newbury from 1874 to 1880, over territory five miles square. Custom smelters were built on the wharves of Newburyport and others out in the wild part of Newbury, where most of the mines were located. The Merrimac had its own smelters and own mill and was the only company to pay dividends. It paid nearly $100,000 in dividends in one of the years that it was operated, but would not have done so if notice had been taken of worn-out machinery and new machinery needed, or of the development work necessary to find new orebodies. When capital had to be replaced it was hard work raising it and ruined the value of the stock. When, after this, the mine was sold out, the new company fully equipped the mine with new and perfectly working machinery, but discovered too late that its officials had bought a salted mine and had no ore to treat. This company did not attempt to find more ore, but closed down for good, and the mine was not reopened until 1919, when new buildings were erected and new equipment was installed, for which the public subscribed to the tune of $140,000 to keep the mine open during 1919, 1920 and 1921. Unfortunately, the way the money was spent did not show whether any ore could be developed in the mine or not, for no real development work was undertaken, excepting in curb broker's offices. With the officers under arrest and the mine in bankruptcy, everything was sold at auction under order of the court on Oct. 2, 1922, to one Horton Batchelder, of Boston, for the small sum of $1,500. Mr. Batchelder took the deed to the land, all the buildings, all of the machinery, and finally all the ore, whatever that may amount to.

From 1874 to 1880 four large mines were operated in Newbury on a large scale, and a considerable force of men were employed. Newburyport took on the look of a Wild West center, and gambling and other kinds of high living gave life to the sober-minded city. Even a firm manufacturing mining machinery came into existence in Newburyport.

An hour's automobile ride, over the newly opened million-dollar Newburyport turnpike road out of Boston, will take a person through Newbury, with its mining locations of the old mines immediately on either side of the road. If one enters Newbury over the other Boston road, the "Shore Road," he is obliged to drive his machine over a filled-in shaft hole in the middle of the road just as he crosses the Newbury line.

There was a peculiar thing about all the ore-bearing ledges. The ore was found either in a dike or near one. It was usually found sprinkled through the rock with pockets in places. In spite of the fact that the only large body of ore was found at the junction of a dike and what was called the "lode," that was the only one opened up in that manner in Newbury. Either the old miners did not seek the contacts or did not believe them worth exploring, or they could not find them.

The United States Government in its reports on volcanic Newbury does not mention the dikes, and few know of their existence, but there are two different kinds of dikes crossing Newbury. Parallel dikes run almost absolutely north and south except where they curve. One of these can be traced five miles. Other parallel dikes run in a general east-and-west direction, not laid down, however, as straight as a ruler. These different kinds of dikes meet or cross at a particular part of Newbury, coming as a whole to an apex. What old-time miners called the "lodes" or veins run in a general northeast and southwest direction, and everywhere they meet with the different kind of dikes and come into contact with them. Every few years prospecting is attempted on a small scale, but whether it is $10,000 that is spent or $140,000 the money is lost.

The results of mining in Newbury have been such as to discourage any more of it, but any geologist will find much to amuse him if he finds one of these dikes and follows it. Almost on the streets of Boston, the mineralized land offers a fine experimental ground for testing the many ore finders heard of. FREDERICK E. GREEN.

Newburyport, Mass.

Many Men, Many Minds

THE EDITOR:

Sir—I have read with interest your editorial, "Teaching as a Profession," in the Feb. 10 issue of the *Engineering and Mining Journal-Press*. I cannot see that there is much danger of the scientific viewpoint being seriously disturbed by two college professors advocating a different article of proprietary make, in the sale of which they may be more or less interested. The chances are that two impartial consulting engineers engaged in solving the same technical problem would not agree to use the same specific article.

It may be beside the point, but the world is certainly made up of many and divergent opinions, and great minds do not always flow in the same channel. A man should be allowed to exercise his own views, whether he be college professor, geologist, lawyer or grafter. It is true that the gentle greasing of the palm of the hand with cash will do wonders in molding opinion, but it is only natural for a man to be loyal to his employer.

I do not believe the mining engineer who was "up against" a real technical problem, in the case you mentioned, was any more at sea after his interview with the two college professors than the untechnical judge will be in the forthcoming Anaconda-Davis-Daly litigation. Witness the array of geological talent marshaled for battle on each side of the controversy. One is a college professor of world-wide renown too.

San Juanito, Chihuahua, Mexico. C. W. HALL.

Examination of Tin Deposits in the Federated Malay States—I

Details of Organization of Work and Methods Employed by Yukon Gold Co.—Maps and Surveys—Construction of Banka Drill and Manner of Using—Cost of Boring

By J. B. Newsom

AN EXAMINATION of tin-bearing lands in the Ampang Salak district, State of Selangor, Federated Malay States, formed part of the exploration work done by the Yukon Gold Co. in 1920 and 1921. The information concerning it given in this article is published through the courtesy of that company.

At the time the examination was begun, the area under consideration consisted of about 2,000 acres of ground, made up of some large blocks of connected holdings, other smaller blocks, and a number of individual mining claims. During the course of the examination a number of additional blocks were taken under option, which increased the total area covered to about 4,000 acres. When the examination work was in full swing, from twelve to fifteen drill crews were employed. More than 3,500 bore holes were sunk to bedrock.

The objects of the examination were: First, to secure all possible information bearing on the value of the properties from a mining standpoint, and their suitability, as to their physical characteristics, location, and other related factors, for working by the dredging process; second, to eliminate the ground which did not contain sufficient tin for profitable dredging or of which the physical characteristics were unfavorable; third, to make as accurate a determination as possible of the amount of tin in the areas which were not eliminated in the early stages of the examination; fourth, to arrive at the probable return from dredging the ground and decide on the advisability of purchase of the whole or a part of the properties.

The entire development program had to be completed within one year from the time the first options were taken, and a number of the options were for only three to six months. To cover such a large area of ground in this short time, it was necessary to organize the work down to the last detail, so that it would go on without interruption and all the results could be tabulated and conclusions reached in time to anticipate the payments which were falling due. It is my purpose to discuss in this paper the organization of the work and the methods used. The interpretation of the results and the final tabulations and valuations of the various blocks are not given, as this information is not available for publication at present.

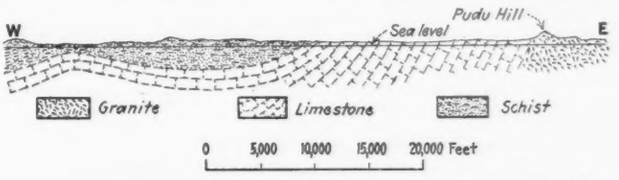
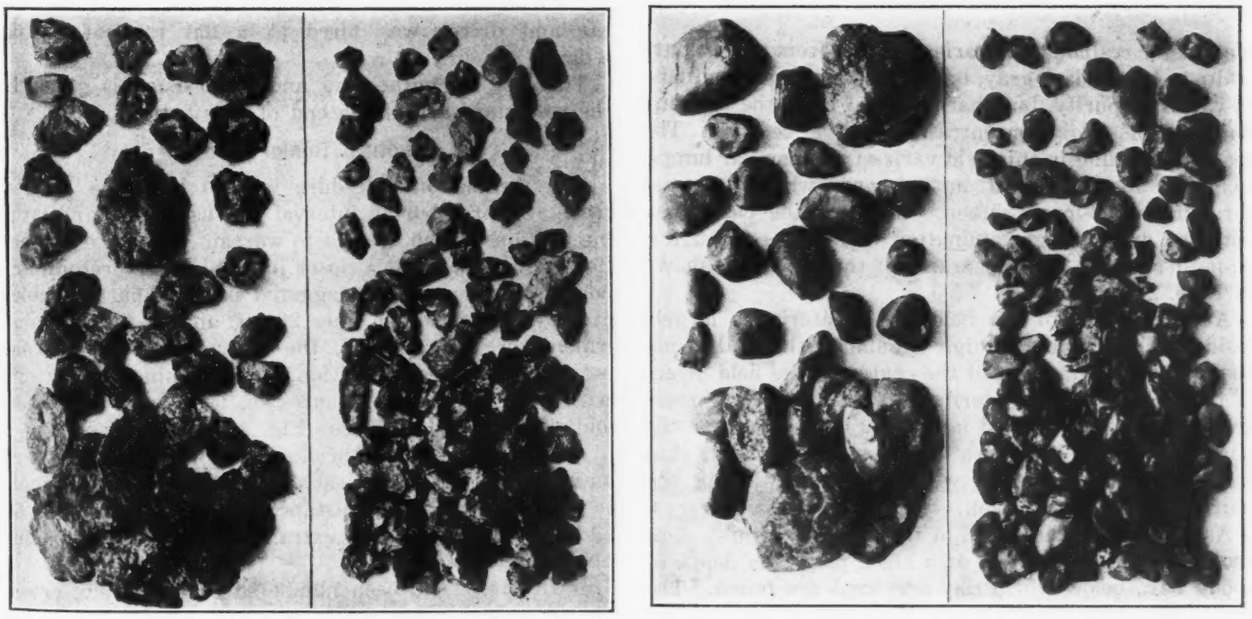


Fig. 1.—Generalized section across Ampang Salak Valley, through Pudu Hill, looking N. 9 deg. E.

A brief description of the Ampang Salak area will be helpful to an understanding of the character of the deposits and the size of the undertaking. The Ampang Salak field is about four miles east of Kuala Lumpur, the capital of the Federated Malay States, and covers about 14,000 acres, most of which is dredgeable. The depth to



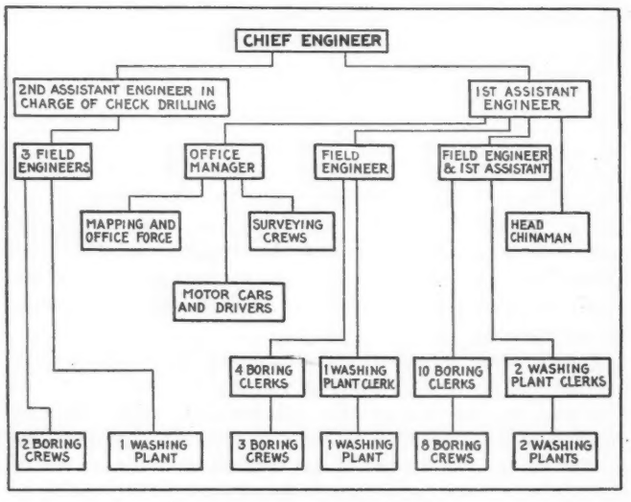
Figs. 2-3.—Left, typical residual cassiterite. Note absence of water wearing. About four-fifths actual size. Right, typical alluvial cassiterite, showing rounded character and waxy lustre

bedrock in the parts examined varies from 10 ft. to over 100 ft., with an average of 35 ft.

The field is practically flat, with a few slightly rolling hills bordering it, and contains several high tailing piles from operating mines. It is entirely surrounded by a range of hills about 500 ft. high. A large part of the valley, especially that which was drilled during the examination, is swampy.

The bedrock of the valley floor is limestone, much pitted and dissolved along fracture and bedding planes. The rim is granite; the contact between the limestone and the granite is at the base of the hills surrounding the flat. In the southeastern part of the area, the granite hills give place to schist, the limestone dipping under the schist hills. Fig. 1 is a generalized geologic section across this part of the area, showing the relations of the granite, limestone, and schist.

The only mineral of commercial value in the field is cassiterite, the oxide of tin. Cassiterite is easily recovered by gravity. It has the following characteristics: Chemical formula, SnO_2; 79 per cent tin when pure; specific gravity, 7.0; hardness, 6.5; practically insoluble; luster resinous. It varies in color from almost pure white to black; dark gray, brown, and black predominate. It varies in purity, but that obtained from the Ampang Salak field is easily concentrated to 73 per cent tin. The cassiterite found in this field varies from angular lumps, weighing about a pound, to fine sands which will pass through a 200-mesh screen. Most of the cassiterite obtained during the examination would pass through a 20-mesh screen. The appearance of the mineral is shown in Figs. 2 and 3.



Organization chart

At the margin of the field the cassiterite is largely residual, showing by its high angularity that it has not been carried far. Toward the center of the field layers of rounded alluvial cassiterite were found. The Chinese are now working several large contact deposits at the northern end of the area by open-cast methods, but valuable contact deposits were not found during the course of the examination.

As has been stated, much of the area is swampy. The ground generally consists of a black mud to a depth of about 4 ft., below which clay and sand are found. The clay is any color from white to dark brown, with yellow varieties most common, and grades from soft mud to hardpan. The sand is from white to yellow in color, its grains differing in angularity and ranging in size from ¼ in. to through 30 mesh. The clay and sand are seldom found unmixed except in tailing piles. On the average there is about 40 per cent of sand by volume in the area. Gravel is not found in appreciable quantities.

Since the mining claims were not all connected and new options were coming in from time to time, it was necessary to adopt an elastic plan of work in which the surveying and boring forces could be expanded if necessary. When the examination was in full swing the organization took the form shown in the accompanying chart.

The chief engineer had general charge of all the work from the preliminary to the final examination stage. He decided on the options to be taken, what ground was to be bored, and the general character of the boring, whether preliminary or close boring. He was also responsible for the accuracy of the work, the final calculations, and the reports to the home office on which decisions regarding purchase of property were based.

The first assistant engineer had charge of all the field and office work under the general direction of the chief engineer. The second assistant engineer had charge of check drilling. The field engineers had charge of the boring crews and the washing plants. Their principal duties were to keep the work moving and to watch constantly for attempts to tamper with results.

The head Chinaman was an important man. His duties were to find drilling sets and crews to operate them, to furnish other labor, to find living quarters for the labor, and to conduct all dealings with natives for the examination forces.

A boring clerk, or foreman, was in charge of each drilling crew. He watched the crew to see that the drilling was properly done, recorded the depths of hole and pipe, and handled the samples. As he was the only one at the drill who could talk English, he acted as an interpreter for the engineers. Extra clerks were kept for emergencies, such as sickness or incompetence on the part of one of the regular clerks.

On account of the large territory which it was necessary to cover, the company provided three motor cars for the service of the engineers. In addition, a service car and driver was hired at a flat rate of $12.50 a day.

The cost of engineering and supervision is given in the cost summary at the end of this article.

Ground Bored Twice

The method of procedure was to bore the ground twice. A large boring interval was used first, and later the portions which seemed to warrant further examination were re-bored at a closer interval. The preliminary boring was done on a staggered pattern, putting holes at 400-ft. intervals on lines 200 ft. apart. In the parts which were re-examined, the intermediate holes were put in during re-examination, thus finishing the pattern with holes in 200-ft. squares on lines east and west, and north and south. See Fig. 4.

As will be noted, the preliminary boring was done at an interval of 283 ft. in each direction, making one hole to 1.8 acres. In a few instances boring was done at 50 and 100-ft. intervals, the extra holes following the same numbering plan.

If the holes had been numbered consecutively, cross-reference between borehole logs and examination maps would have been difficult. The size of the claims varied so greatly that it was impracticable to treat each block

as a separate unit, so reference to the location of the holes was made solely by co-ordinates.

On the assumption that no boring intervals of less than 50 ft. would be used, a system of co-ordinates, one line to every 50 ft., was laid out as follows: Lines running east and west were designated by a number followed by a letter—thus: 20-A. Before each capital letter, the lines were numbered consecutively to 23, when the next letter was started. Thus, the line 50 ft. south of the 23-A line was called the B line, and 50 ft. further south was the 1-B line. The north and south lines were numbered consecutively from west to east, starting with 1 and ending with 1,000. See Figs. 4 and 5. Should the proper position for a hole happen to be in a lake or some such inaccessible spot, the hole was offset to the nearest accessible place and given the co-ordinate number of the point to which it was moved.

The co-ordinates covered an area about 9½ miles east and west, and 6 miles north and south. Some of the claims examined extended a little beyond the southern limits of the lettered co-ordinates. These claims were included in the co-ordinate scheme by using lower case letters instead of capitals.

Scale and Size of Maps Determined

The units of measurement used by the land office of the Federated Malay States were the surveyor's chain and link, and its land maps were issued on scales of an even number of chains to the inch. The government maps were used wherever possible, but one foot was taken as the unit of length for maps and measurements made during the examination. The chief reason for this was that it simplified the scale used on cross sections and on topographic maps.

A few topographic maps were made where the land was rugged enough to raise a question as to whether it was possible for a dredge to move ahead. These maps were made on a scale of 200 ft. to the inch, using a 10-ft. contour interval.

Office maps were also made on a scale of 200 ft. per inch. It was impracticable to use an office map covering the whole area on one sheet; therefore the area was divided into several units of standard size, each covered by an office map or sheet. Each unit extended 10,000 ft. (200 lines) east and west and 4,800 ft. (96 lines) north and south, which, mapped on a scale of 200 ft. to the inch, made each office sheet 24 by 50 in. in size. These maps were drawn on tracing cloth.

The surveyor's maps were duplicates of the office sheets, on heavy drawing paper. Only one surveyor's sheet was made for each office map.

Cross sections were made on a horizontal scale of 100 ft. to the inch. Cross-section sheets were cut the same size as office maps, which meant that a map contained four cross-section sheets, each covering 5,000 ft. (100 lines) east and west, and 2,400 ft. (two letters or forty-eight lines) north and south. See Fig. 5.

The surveying crew was required to set and mark the drilling stakes. It also made a field map on a scale of 200 ft. to the inch, showing the various ponds, streams, roads, paths, mines, dwellings, claim corners, and the boring stakes, with the elevations of the stakes above sea level. In some cases thirty stakes a day had to be set. To set a stake during the preliminary boring campaign, it was necessary to run 400 ft. of line, but the close boring stakes could then be set without cutting additional lines. In some places, swamp conditions were so bad that two men could not cut over 400 ft. of line a day. Occasionally the mud was so soft that reed mats had to be made and laid on the surface to enable surveying coolies to pass.

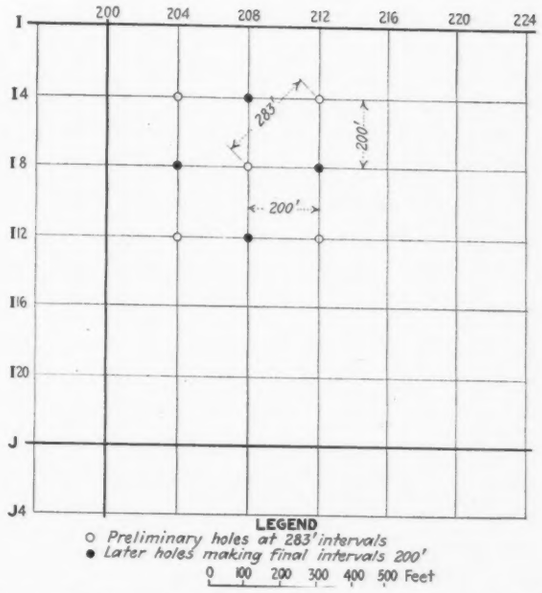


Fig. 4.—Section of borehole layout for Ampang Salak examination (see Fig. 5), showing location and spacing of preliminary and final boreholes

Field maps were tied in so that boring points could be re-located within 10 ft. Any later boring campaign, (such as close boring before a dredge) could then omit the holes which were put down during preliminary examination.

Iron bench marks were placed in the center of each subdivision throughout the area. These bench marks consisted of a 2-in. pipe 6 ft. long with a 2-ft. tee pipe welded on the upper end and the lower end brought to a point. The bench marks were tarred before setting and were driven into the ground about 5 ft., with the tee pointing due north and south.

Bore holes were marked with wooden stakes 4 ft. long, 1 by 3 in. in cross section, planed on opposite sides, and driven 2 ft. into the ground. The number of the hole was marked on both sides of the stake. To each stake was fastened a thin pole about 20 ft. long with a strip of white cloth tied to the tip to act as a marking flag. The surveying equipment used consisted of an

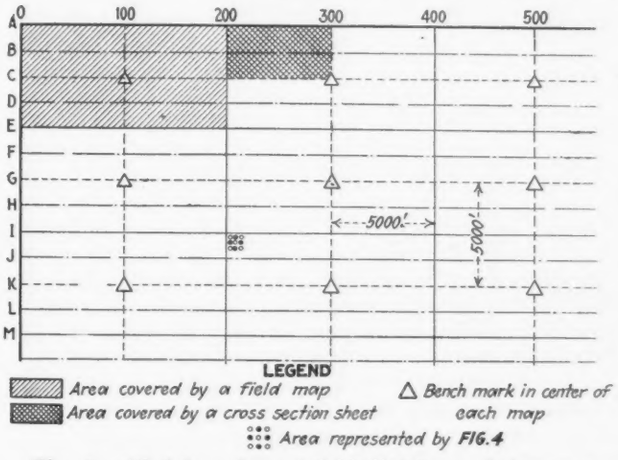


Fig. 5.—Skeleton plan of field divisions of Ampang Salak boring layout

American transit, several magnetic compasses, and one steel tape.

The transit was fitted with stadia hairs, and the stadia method of measurement was used in much of the work. The transits available in the country were not used, because they lacked stadia hairs. Chinese carpenters made strong, accurate stadia rods for about $2 each.[1]

The compasses were fitted with tripods and sighting slots, and were arranged to read in azimuth, the scale

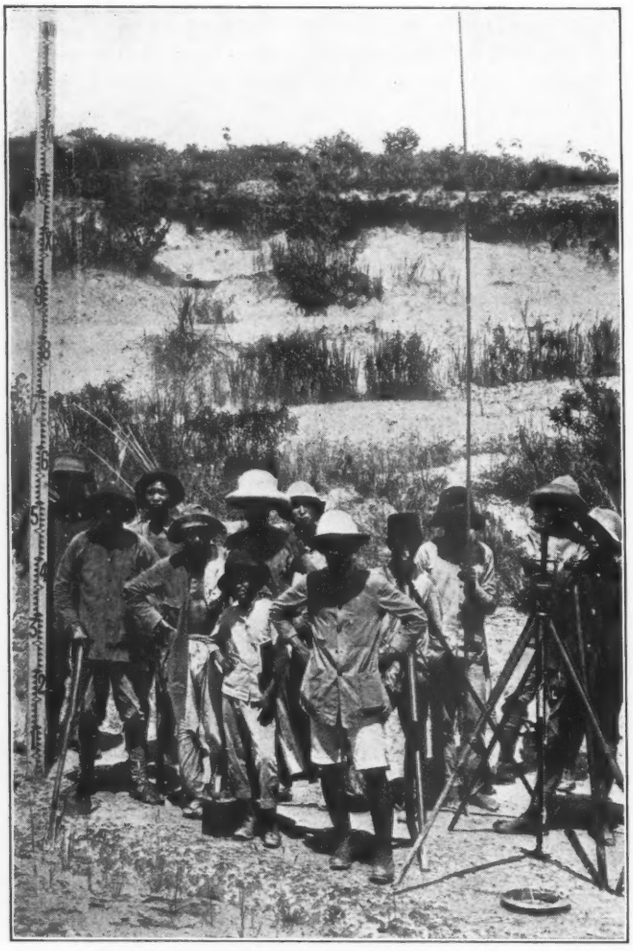


Fig. 6.—One of the surveying crews

being fixed on the needle and turning with it. Experiments showed that the compasses had individual magnetic declinations; in one case, a variation of over 5 deg. These compasses were high-priced and were not satisfactory; however, the need for them arose suddenly and more accurate instruments could not be readily and economically supplied.

The lack of steel tapes was remedied by using fine wire cable. This was cut into lengths of 100, 200, and 400 ft. and marked by wrapping it with copper wire. It was found better to have few marks on the tapes, as the coolies were then more likely to use the right one.

The size and organization of the surveying forces varied, the average crew consisting of twelve men. See Fig. 6. When the work was light the surveying could be done by four men, and when it was heavy forty were sometimes used. The crew shown was managed by a Javanese surveyor, a fairly good transit man, who received a salary of $100 per month. He was able to care for the transit, read stadia, calculate elevations from vertical angles, with the aid of a stadia chart, and make a topographic map using stadia methods.

The compass men were Chinese or Malays, who were taught to handle compasses when they were hired. They were paid about $20 a month. They were capable of running a straight line if they did not have to offset in order to survey around houses or lakes, and could manage a tape and set stakes.

Coolies did the unskilled work and were paid from 30 to 50c. a day. Malays were found to be superior to Chinese as surveying coolies.

The following table gives the organization and wage scale of the crew shown in Fig. 6.

Surveying Organization, Wage Table and Costs

Surveying fifteen holes a day in swamp

Position	Daily Wage	Daily Total
1 transitman	$3.30	$3.30
4 coolies	.40	1.60
1 messenger boy	.35	.35
2 compass men	.65	1.30
4 coolies	.40	1.60
Total—12 men		$8.15

The average cost per 100 ft. of line surveyed was 18c. The cost of setting one stake was: labor 55c., materials 3c. Materials includes stakes, flags and poles for flags.

Special Efforts to Maintain Accuracy

Early during the examination it became evident that the required accuracy could not be maintained unless the survey was tied in every mile or two. Ordinary survey stakes and lines were usually entirely obliterated within a year's time, due either to destruction by white ants, Chinese women gathering survey stakes for firewood, or the rapid growth of underbrush in the tropics. It was found that claim corners were not good points to which to tie a survey, for they were often hard to find and many of them had been moved by landowners. For these reasons a bench mark was located on the spot represented by the center of each field sheet. See Fig. 5. All the surveying done on any given field sheet was tied in to the bench mark in its center. Thus, no transit line had to be run more than 5,000 ft. from the bench mark. The bench marks were located by triangulation to the government triangulation stations, and were set to the nearest foot.

As many stakes as possible were set by transit. Compass lines were seldom run more than 1,200 ft., as a longer compass line was often inaccurate.

In the swamps all holes were given the same elevation, but on hilly ground the elevations of holes were found by vertical angle with the transit.

When orders were given to bore a piece of land, the engineer in charge of surveying determined by inspection from a skeleton map which office sheet would cover the ground. If the bench mark for the sheet on which the land fell had not been set, a white surveyor set it, using a powerful theodolite. The approximate position of the boundaries and corner stones of the land to be staked was then marked on the surveyor's sheet. The holes to be staked were indicated by drawing a cross through the spots which they were to occupy on the surveyor's sheet.

The surveyor then took this sheet into the field, and as he put in each stake he drew a ring around the spot representing the stake on the map, and noted the elevation beside the ring. The numbers of the co-ordinates on which the stake was put were marked on each stake.

[1]All costs given in this article are in United States currency.

When the work was completed the sheet was returned to the office. The data contained on the field sheet were then traced on its corresponding office sheet, and the surveyor's sheet was filed.

Hand drills of the Banka type were adopted as best suited to conditions in the Malay States. These drills are good for depths of 100 ft. or less in the ordinary Malay deposit of sand and clay. The drills are simple and strong in construction and have no complicated parts. The heaviest single piece weighs less than 100 lb., and the drills are easily transported on the backs of men. The most important parts of the Banka drill are shown in Fig. 7.

The parts are lettered in the illustration to correspond with the following description:

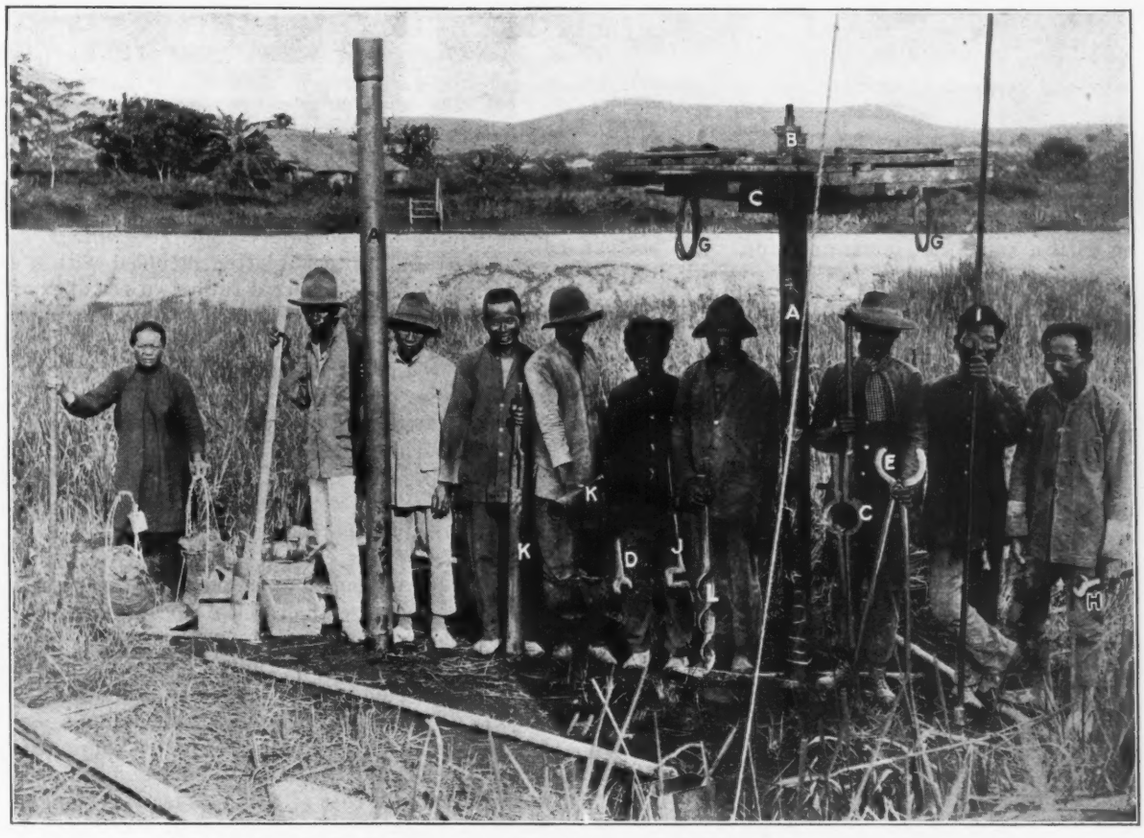


Fig. 7.—Principal parts of Banka drill with its operating crew. See text.

The drill pipe or casing *A*, is steel, with ¼-in. walls and an inside diameter of 3½ or 4 in., preferably 4. The pipe is in 5- or 10-ft. lengths connected by threaded sleeve joints. Small V threads are used. The threads wear out rapidly, are easily smashed, and have a tendency to spread the sleeves when put under heavy strain. An unsuccessful attempt was made to secure joints with large square threads. At the beginning of operations, some drill pipe which was connected with lugs and slots was used, but it was troublesome to couple and uncouple. A few sets of smooth joint casing were tried. This casing was fastened together with threads set in the walls of the pipe. The walls were made thicker near the joints, but the extra thickness was taken up on the inside of the casing, which left no bulge on the outside. The smooth joints permitted the pipe to rest against the side of the hole throughout its entire length. This caused so much friction that it was almost impossible to turn the pipe, and so the smooth joint casing was discarded. Sleeve joint casing was much easier to turn, because the sleeves reamed out the hole every 5 ft., so the only sources of friction were the sleeves themselves; the rest of the pipe turned free.

A cutting shoe (not shown) is screwed on the lower end of the pipe. It is a circular shoe, made of tempered steel with a smooth cutting edge. These shoes seldom became dull, because gravel is seldom encountered in the Malay States, and sand and clay wear the sides of the shoe without blunting it. Dull shoes were resharpened and retempered in a native foundry.

The driving head, *B*, is a heavy iron collar threaded to fit the sleeves of the pipe. It is kept on the upper end of the string of casing to protect the threads from injury.

Pipe clamps, *C*, are two-piece clamps fastened by a heavy bolt through each side. The ends of the clamps are extended about 2 ft. and rounded, making excellent handles. Heavy strain is often put on the clamps, but if the bolts are tightened, they seldom slip. Three pipe clamps are usually included with a drilling set.

An end wrench, *D*, is used to tighten the bolts of the pipe clamps. The pipe tongs, *E*, are used to grip the pipe, should it tend to slip back into the hole when being pulled out.

The drilling platform, *F*, is 3 ft. square, is made of wood, and is an excellent substitute for the iron platforms advertised by the makers of these drills. It costs $1.50. It has a hole in the center for the pipe, and when in place rests on two clamps crossed near the top of the pipe. Notches in the platform prevent turning on the clamps.

Turning slings, *G*, are braided rattan hoops 8 in. in diameter, looped over the ends of the pipe clamps.

The turning levers, *H*, are hardwood poles 10 ft. long. They are used to turn the pipe as shown in Fig. 8.

The drill rods, *I*, are solid steel about an inch square, made in 10-ft. lengths and connected with heavy threads. Near the joints they are made larger, so that, if the handling wrenches should slip, the rods could not slide into the hole. All tools in the hole are handled from the drilling platform by rods, and are made so they can be screwed to the bottom rod.

The rods are handled with wrenches, or dogs, *J*, having handles about 1½ ft. long. They are made of squared iron with rounded handles. The opening is wide enough so that the wrench will slip easily over the drill rod but not over the flare at the rod joint. Fig. 8 shows how the hand dogs fit and grip the drilling rods.

Soft mud and sand are lifted out of the hole with a sand pump, *K*. This pump is a piece of pipe about 3 ft. long and small enough to fit loosely inside the drill pipe. The lower end is shod with a circular cutting shoe to which an inward-working check valve is attached. The pump is open at the top so that it can be emptied by inverting. It is attached to the drill rods by a fixed bail. The pump is filled by spudding it in the hole.

Soft clay is removed with a clay pump. This is a cylinder with a small slot down one side. The bottom of the cylinder is turned in to form a screw feeding device. When the pump is lowered into the ground and turned around, the screw feeder forces the clay into the cylinder. The slot makes the tool easy to clean.

Fig. 8.—Banka drill in use, showing how pipe is turned, how hand dogs are attached, and how depth of pipe is indicated by chalk marks.

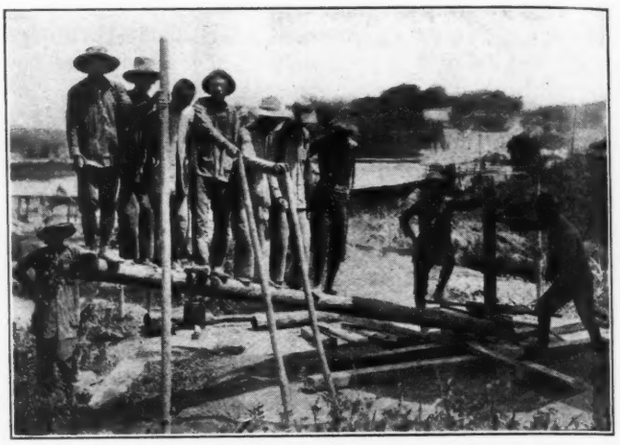


Fig. 9.—Pulling pipe from completed hole

Stiff clay is removed by a clay auger, *L*, which is similar to a large wood auger.

A sand pump can be driven through soft clay by turning it in the same manner as a clay pump, but in hard ground a clay auger or light rock bit is better. Most drilling sets contain a light rock bit.

A rod-grappling tool is often included with a drilling set. This tool is an inverted funnel, at the apex of which is a set of threads which fit the upper ends of the rods. When lowered into the hole the funnel guides the head of the lost rod into the threads. The rod is then screwed on by turning the tool.

Spring darts are included with many drills. They are used in pulling up the lower end of a string of pipe which has been broken off in the hole. A spring dart is an anchor-like tool with a sharp point on the bottom. It can be put into the hole and forced down lower than the end of the pipe. When pulled up, two iron wings in the tool spread and engage the bottom of the cutting shoe. The rods are then pulled up with the pipe.

The following extra equipment was furnished to each drilling crew: A 15-ft. timber 6 or 8 in. in diameter, about six wooden blocks, a hand axe, and a burlap sunshade with ropes and poles to string it up.

The total price of one of these drills, equipped to drill to a depth of 100 ft., is $400. Most of the drills used were rented at a cost of $30 a month for each set. The life of a drilling set is measured by the life of the pipe, which is about two years of constant service. Translated into footage this gives a life of 20,000 ft. This long life is due to the fact that a large part of the drilling is done in clay, which does not wear the pipe.[2]

The Banka drill is operated by a crew of eight men, as follows: The bottom length of pipe with shoe attached is set up and turned around by hand. Its weight forces it into the ground. It is kept plumb by eye. As soon as it will stand alone the drilling platform is set on two pipe clamps which were attached before the hole was started. One of the coolies climbs on the platform to add weight while the others continue the turning. As soon as the pipe is in the ground so far that it will not tip over from the added weight, three more coolies climb on the platform and the operation of drilling starts.

The coolies on the ground turn the pipe around to the right as shown in Fig. 8. They keep turning until the pipe has almost stopped settling. Then the coolies on the platform attach one of the drilling tools to a rod and

[2]Data on life of pipe were secured from several Chinese mine owners and owners of drilling sets in Kuala Lumpur.

begin to remove the dirt from the inside of the pipe. When the tool used is filled with dirt, it is lifted to the surface, emptied into a sample box, washed off and returned to the hole. When the dirt is removed almost to the bottom of the pipe, the pipe is turned again.

When the hole has reached its full depth, the pipe is pulled up with levers applied as shown in Fig. 9. Sometimes as many as thirty-two men are used in pulling pipe. If the pipe is hard to pull, it is turned at the same time that the upward pressure is applied.

Occasionally the pipe shows a tendency to slip back into the hole. This is guarded against by always having one clamp on the pipe. Temporary slipping back is prevented by holding with pipe tongs.

Sometimes the pipe twists off at a joint. The pipe below the break is either abandoned or is removed with a spring dart or sand column. A sand column is made by lowering a sand pump into the hole and covering it with three or four bucketfuls of clean sand. A bucket of water is then poured in to settle the sand and the column is left overnight to allow the sand to pack. The pipe is then lifted out by pulling on the rods.

The drill rods are heavy, and an average crew cannot efficiently handle a string of rods over 100 ft. long. This places a limit of about 100 ft. on the depth of holes drilled by this method. Fastening and unfastening many lengths of rod takes so much time that drilling speed slackens greatly as depth is gained. See Fig. 10.

Barren holes were abandoned at a depth of 70 ft., but good ground was drilled to a depth of 90 or 100 ft., unless bedrock was previously reached.

In the worst of the swamp, bamboo and plank drilling platforms of the type shown in Fig. 11 were built and bamboo bridges were constructed to furnish good footing for coolies carrying drill pipe. No drilling was done in more than 6 ft. of water.

Shafts were not put down, because of the difficulty of keeping them free from water. Power drills were not used, because of the difficulty of building roads and the high cost of operation.

Most drilling coolies in the Malay States are paid by the foot drilled, so they try to finish each hole as quickly as possible. To do this they get the sand pump full of dirt and then use it as a battering ram to punch out a hole far ahead of the pipe. Consequently, the samples obtained are small, and the depth from which they came is not accurately known. Contract coolies often try to convince the engineer in charge that they have struck bedrock when they simply have hit a bed of hard clay. Drilling by contract is cheaper per foot of hole, but to obtain the best samples possible crews were hired by the day.

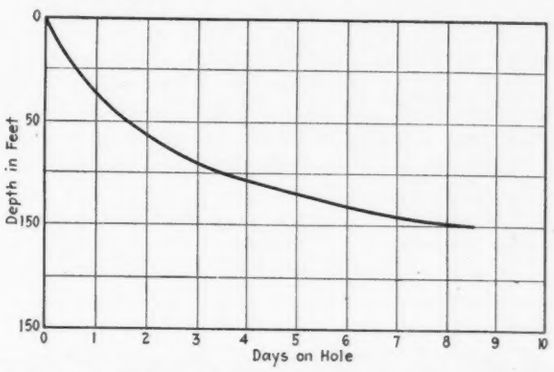


Fig. 10.—Rate of drilling, Ampang examination, 1920. Average time for drilling one hole.

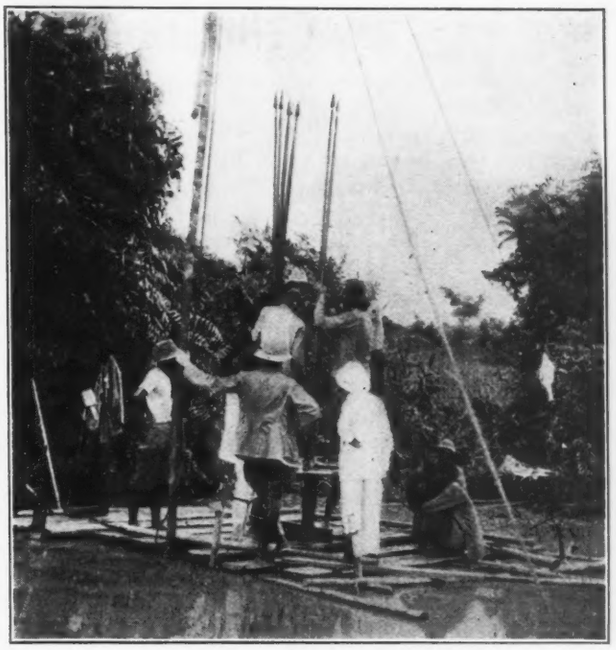


Fig. 11.—Type of platforms built when drilling in swamp. Photo by Fox.

The labor was furnished by Chinese contractors, each of whom furnished two to four crews. Care was taken to employ crews from more than one contractor. Thus an element of competition was introduced. Each crew in the field was assigned a number, and this number was put on every log representing a hole drilled by that crew. The drill number was used in looking up the diameter of the cutting shoe, the name of the contractor, the name of the head coolie (Kapalla) and in comparing work done by different crews or work done with special sets of casing.

The following table gives the cost of boring for the examination:

Cost of Boring—Ampang Examination (1920)

Contractors paid $8 a day for a crew of eight men.
28 working days per month.
Average depth of holes, 35 ft.
25 ft. per drill day in swamp.
30 ft. per drill day average for 1920.

Item	Cost per Month per Drill	Cost per Foot In Swamp	Cost per Foot Average
Crew	$224.00	$0.32	$0.27
Drill rent	30.00	.04	.04
Repairs	10.00	.01	.01
Moving drills and bridges	1.50	.01	.00 +
Totals	$265.50	$0.39	$0.32

As a check on the original results, two "check drills" were operated over a period of several months. Ordinary drills and crews and the usual method of handling samples were used. The crews were each supervised by an American engineer paid $200 a month, and the washing plant was supervised by an American paid $175 a month. Samples from check drills were carefully handled and were never allowed out of sight of an engineer. Logs from check drills were figured by natives but checked by an American.

Each check hole was put within 3 ft. of the original hole. It is interesting to note that usually the check holes were lower in value than the rich holes and higher in value than the poor holes. The average value of check holes was about 5 per cent less than the average value of the original holes they checked.

To be concluded.

Utilization of Waste Material

Tailing and Slag—Stope Filling—Material for Concrete—Road Metal—Manufacture of Brick and Tile—Railroad Ballast—Tube-Mill Pebbles

By A. W. Allen
Assistant Editor

THE PRINCIPAL WASTE PRODUCTS of the operation of mines, mills, and smelters are tailing or residue and slag. Granular tailing is being utilized successfully as an efficient and economical filling for underground workings. In this connection it is interesting to note that the avoidance of the sliming of raw ore in chemico-metallurgical operations insures a supply of sand that is suitable for such a purpose. Some of the gold mines of the Witwatersrand return underground as much as a quarter of a million tons of sand per annum, the residue from leaching vats. The roasted and fine-ground residue from the operation of filter presses in Western Australia has been found satisfactory for the same purpose. Attempts have been made elsewhere to utilize the wet residue from vacuum-filter plants that treat raw ore, but no success has been reported. Such material should pack easily and drain quickly. Sand—the coarser the better—is ideal for the purpose. River sand, when available, is used in coal-mining operations, especially where a reduction in fire hazard is an important consideration.

It is not widely known that the tailing from the concentration of ore may serve, if properly prepared, as a desirable dressing for soil. The American Limestone Co., a subsidiary of the American Zinc, Lead & Smelting Co., manufactures a high-class pulverized limestone product, suitable as a dressing for soil. This is the tailing from the operation of the plant of the American Zinc Co. of Tennessee, at Mascot, also a subsidiary of the A. Z. L. & S. Co. The Zinc company's concentrating plant has a capacity of about 2,400 tons per day, 1,000 tons of which, as tailing, goes to the annex plant for grinding and preparation for the market.

Sand and gravel are salable in many districts. A new industry has arisen in parts of California, by which sand, deposited in river beds as a result of hydraulic mining operations, is reclaimed for industrial purposes. At one plant the material is removed by grab bucket, then washed, screened, and divided into two products—¼ and ⅛ in. These are stored for delivery to railroad cars and distributed over an area represented by a radius of as much as 200 miles from the reclaiming plant. The sand and gravel produced have been found especially suitable for making concrete in connection with power projects, dams, and general building construction. Similar uses have been found for the boulders discarded during hydraulic mining. These are crushed and screened, and sold for a variety of purposes for which rock is needed.

Use for "Chats" and Iron-Ore Residue

The tailing from the zinc mills in the Joplin district, known as "chats," is used extensively for road surfacing in Missouri, Kansas, Oklahoma, and Texas—as top dressing and also as a constituent of the surfacing aggregate. The product, ranging in particle size from about 1½ to ⅜ in., is ideal for making concrete for roads, bridges, sidewalks, curb and guttering, blocks and reinforced structures, within a radius of the mills determined by the cost of shipping, as against the cost of producing crushed rock in the particular locality. The Joplin Special District has built 65 miles of concrete highway with this material, and its further utilization is planned for the construction of several hundred miles of primary roads.

Another interesting example of the utilization of waste material in road building is seen in northern New Jersey, where the reject from the concentration of iron ores is separated into three grades: (1) minus 2 in. plus ¾ in., (2) minus ¾ in. plus ⅛ in., and (3) sand, which is minus ⅛ in. In those mills that use wet processes, the finest product, the sand, is clean and especially suitable for concrete work. Since the utilization of efficient high-intensity pulley-type magnetic separators, which are used to effect the primary concentration, the coarse tailing, clean and remarkably free from iron ore, is in demand locally, selling for $1.25 per ton on cars at the mine; the sand brings 80c. per ton.

The crushed rock is suitable for concrete work, railroad-track ballast, water-bound macadam roads, and in making asphalt concrete. The sand is used for all classes of concrete work, including sidewalks, as top coat on macadam roads, and for making products such as concrete sewer pipe, hollow tile, and brick. The gangue in the ore is almost wholly gneiss. The tailing is hard and of light color—desirable characteristics for the purposes mentioned. Comparative tests on gneiss tailing and trap rock have indicated that the resistance to fracture is 15 per cent less when using the trap.

Manufacture of Brick From Waste Product

One of the most interesting examples of the efficient utilization of waste product is seen in the 550-ft. stack of the Washoe Reduction Works, of the Anaconda Copper Mining Co., at Anaconda, Mont. The brick used was made from the tailing resulting from the treatment of fine-ore slime in Minerals Separation flotation machines, which is settled in inclosures and later excavated by means of Lidgerwood reclaiming machinery. The clay thus obtained, containing about 20 per cent alumina, is allowed to dry in the atmosphere to a point at which efficient manipulation is practicable. Auger presses are used, and wire-cut brick and tile are made. Drying and burning conform to customary practice. The resultant brick is acid proof and has a high resistance to fracture. It has proved a superior product, especially for the construction of flues and chimneys.

Experimentation has proved that the tailing from the mill and cyanide plant of the Opp mine, in Oregon, is suitable for the manufacture of building brick. The product, made by the sand-lime process, has been passed as of superior quality and has been specified for two large buildings, one at Medford and another at Grants Pass. The sand from the plant varies in size from 60

to 100 mesh, the finer material being in demand for asphalt paving and roofing. The mine is on the railroad, and brick and fines can be shipped for a distance of probably 300 miles.

Grinding Media for Tube Mills

The gradual exhaustion of the reserves of soluble copper ore, the need for the extended comminution of the gangue to isolate sulphide mineral so that successful concentration may be practiced, and the wide adoption of the flotation process, have served during recent years to deflect a considerable amount of attention to the problem of cheap and efficient fine grinding. Since the introduction of the tube mill in metallurgical plants late in the last century, flint pebbles, imported from Europe, have been used extensively as grinding media, but the cost of transportation has been found to be excessive and, in some cases, prohibitive.

In Mexico, in 1911, I managed to solve the problem satisfactorily by the manufacture, using cheap native labor, of rough cubes of an unusually hard quartz, resembling flint, which were afterward rounded in a tumbler mill. The cost per ton of finished product was about $6, compared with $70 per ton for the imported flints. Later, in South Africa, I used roughly shaped spheres of trap rock, fashioned by Kafirs, and introduced direct into the tube mills. These cost about $4.75 per ton and did more and better work than imported flints that cost $12.

Frequent reference has been made in the technical press during recent years to the successful substitution of a local stone for the imported flint. In many cases, however, on account of the quantity needed and the absence of cheap labor for preliminary mining and fashioning, recourse was had to small steel balls, usually spherical but sometimes of a special shape. The use of these involved comparatively high first cost and the addition of metallic iron to the pulp; but such disadvantages were offset by efficient operation, due to the high specific gravity of the grinding media, and to its extreme toughness and satisfactory wearing qualities.

Recognizing the impracticability of using local stone in the United States, exclusively or in large part, for the fine grinding of the immense tonnages of low-grade copper ore that must be reduced to sand or slime prior to gravity concentration or for treatment by the flotation process, I decided that the problem might be solved by the mechanical manufacture of a hard and tough ball to be produced cheaply from waste material. I then turned to the data published by the Office of Roads and Rural Engineering and relating to tests that I had found useful to determine the hardness and toughness of rock to be used for the manufacture of tube-mill pebbles, and found a few figures on smelter slag, which appears to me to be a promising waste product to utilize for the manufacture of grinding balls. It is, of course, unusually hard. Its toughness, even after quick cooling, is comparatively high.

I suggested that it might be feasible to utilize the slag that is now going to waste, or at least a proportion of it, (1) by admixture while hot, if found necessary or advisable, with some substance or substances that would increase toughness as well as resistance to abrasion in the finished product; (2) by molding the slag, or mixture of slag and corrective, to produce spheres of suitable diameters; (3) by the careful annealing of the spheres, as practiced in glass works, to prevent cracking and brittleness.

The advantage of the adoption of such a scheme would include (1) the economy resulting from the utilization of a waste material; (2) the manufacture of a grinding medium in extensive demand at points favorably situated for distribution to the large milling plants in the United States; (3) the recovery of the copper in the slag. The scope and efficiency of balls of different diameters and composition would have to be determined by experimentation, using the various types of slag now being produced. These should be tried in contact with pulp of varying degrees of fineness.

Waste slag has been used extensively as railroad-track ballast and for the manufacture of slag wool (for packing purposes). It has proved suitable as a constituent of concrete for roads, cellars and foundation work generally, but its application in this connection has been limited because of weight and consequent heavy cost of transportation. Mechanically, however, it appears to fulfill all demands.

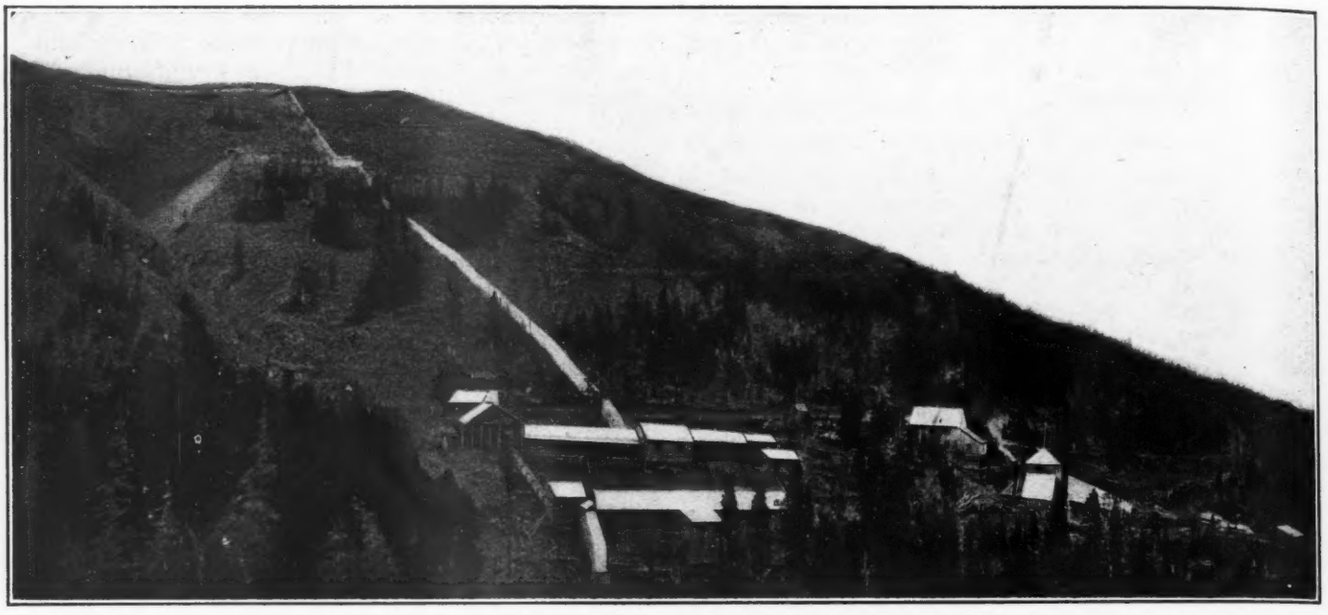
The foregoing notes indicate that the utilization of waste material is a subject of interest and economic importance to the mining industries. The treatment of the subject in this article has been manifestly superficial, but it is hoped that the publication of the notes will encourage further research that will lead to economies in some instances and make possible profitable mining operations in others. For interesting and instructive data on current practice I am indebted to Frederick Laist, of the Anaconda Copper Mining Co.; H. A. Prosser, of the American Smelting & Refining Co.; Otto Ruhl, of Joplin, Mo.; H. M. Roche, of Dover, N. J.; and J. H. Opp, of Medford, Oregon.

Rhyolite as a Grinding Medium in Tube Milling

At the mill of the New York & Honduras Rosario Mining Co., at Rosario, San Juancito, Honduras, rhyolite is used in place of imported pebbles for tube-milling purposes. The ore, a mixture of rhyolite and quartz, is also used for the same purpose. A. R. Gordon, the general manager, states that pieces of rock, varying in size from 4 to 10 in., are selected as the material passes over the grizzly leading to the primary crusher. These are then delivered to a special bin and used in the tube mill without further preparation. The largest pebbles rejected are about the size of unshelled almonds. As about one-half of these consist of ore, all are returned to the batteries.

Physical Properties of Sulphur Trioxide

Sulphur trioxide is supposed to exist in two solid modifications, α and β, according to A. Berthoud in *Helvetica Chimica Acta*. Experiments show that the silky form, β, is probably a hydrated form; it owes its formation to the presence of water, but cannot contain more than 1 molecule of water per 1,000 molecules of sulphur trioxide. The following constants of sulphur trioxide were measured with the greatest care: m.p. 16.85 deg. C.; b.p. 44.52 deg. C. (760 mm.); critical temp., 218.3 deg. C.; critical pressure, 83.8 atm.; critical density, 0.633; molecular heat of vaporization, 10,300 calories; van der Waals' constants, $a = 0.01629$, $b = 0.002684$.



Camp of the Florence Mining Co. near Marysvale, Utah

Alunite and Its Products

Description of the Deposit of the Mineral in the Tushar Mountains Near Marysvale, Utah—War-Time Exploitation—Sundry Products and Byproducts—Henry Ford Plans to Use the Mineral at Muscle Shoals, If He Gets the Chance

BY RICHARD HOADLEY TINGLEY

IN THE MAIN RANGE of the Tushar Mountains, in the Marysvale district of Utah, about 200 miles south of Salt Lake City, is an extinct volcano, Mount Edna, which, in its time of activity, ages ago, filled up the valley, ravine, and fissure with a molten substance which on cooling formed a pinkish spar. For many years the Marysvale miners who were trenching and tunneling the mountain for gold and silver were puzzled when they encountered the spar in veins ranging from 6 ft. to 60 in thickness and at points on the mountainside differing as much as 2,300 ft. in elevation. Thinking it of no value, they consigned it to the dump. Several veins were discovered. Entering the mountains in almost any direction, by tunnel, or shaft, at almost any level, the same pink spar always "bothered" the gold miners, for they could see nothing interesting in it.

The story goes that an old miner, Ole Larson, had been "bothered" a little beyond his patience. The stuff excited his curiosity; so he took a sample to town with him for analysis, and the chemist finally pronounced it alunite, a double sulphate of aluminum and potassium.

Prior to this time it was not known that any appreciable quantity of high-grade natural alunite existed in the United States. Alunite in a more or less impure state had been discovered in near-by Utah districts. Attempts had been made to treat the material for the recovery of its component parts, but the presence of such a large percentage of foreign matter resulted in failure, so far as profitable production was concerned.

With the discovery of the Mount Edna deposit, however, attention was again awakened, and chemists and metallurgists started research to devise a process for the economic recovery of its valuable content. The U. S. Geological Survey became interested, and special investigators were sent to Utah. Their reports are contained in several special bulletins.

In the meantime the owners of the alunite properties in the Tushar Mountains, who had continued to produce gold and silver, had awakened to the potentialities of the despised product that had "bothered" them. They began to wonder if there might not be more profit in mining and treating alunite for the recovery of its valuable products than in mining and treating their ore for gold and silver. They realized, however, that laboratory experiments on the alunite, as conducted by the Geological Survey and others, were not sufficiently conclusive as to technical methods and cost. They decided to go deeper into the scientific phases of the treatment—while still mining for gold—and to determine more accurately, by actual tunnel and shaft work, the true volume of their alunite deposit. They were thus engaged when the World War came.

There are now only two owners of mining claims in this part of the Tushar Mountains that thus far have developed any considerable quantity of alunite in high-grade deposits. These are the Mineral Products Co., a subsidiary of the Armour Fertilizer Co., of Chicago, and the Florence Mining & Milling Co., of Philadelphia. It was upon the claims of the latter that alunite was first recognized. The deposits controlled by the Florence company are said to be the larger of the two.

The property of the Florence company consists of eighty-nine proven claims of about twenty acres each, or 1,780 acres. The company has driven fifty shafts,

tunnels, and open cuts, aggregating over 10,000 ft., exposing alunite on the North Fork, Summit, and Sunshine claims. The longest tunnel is in 3,300 ft. There is blocked out, according to the lowest calculation of the company's engineers, more than 2,785,000 tons of alunite ore, and estimates aggregate 20,000,000 tons in addition. The width of the veins varies from 6 to 60 ft. and will probably average greater than 20 ft. There is reason to believe that the ultimate production will be many times the present estimates.

Thousands of tons of alunite have been shipped from both properties and used for their potash content alone. Incidentally, the openings that have served to block out the alunite have revealed gold-, silver-, and lead-bearing veins. Both the Florence and the Mineral Products companies have partly equipped treatment plants that were used during the war to obtain the potash contents.

War Halted Alunite Experiments

During the war all experimental work was stopped and effort was directed to the recovery of potash from alunite. The main source of potash, Germany, had been cut off, and the price had risen enormously to an average of approximately $4.50 a unit (20 lb. of K_2O). The pre-war price had been about 75c. There was a large demand for the alunite potash, it being potassium sulphate instead of the muriate that had come from Germany and from other American sources. Potash sulphates had always commanded a better price, usually about 25 per cent, over the muriates—a condition which still exists, and of which the manufacturers of alunite potash propose to take advantage when they again place their product on the market.

During this war period about 200,000 tons of alunite was crushed and made to yield its K_2O by the Florence company, and a much larger quantity by the Armour interests before the German muriates again began to appear in this country. The price of potash dropped to approximately pre-war levels, and production of alunite was discontinued. Since then research has been continued to evolve a process for recovering the other valuable constituents of the alunite on a commercial scale. The work of the Florence company has demonstrated to its satisfaction that it is possible to recover potassium sulphate from the alunite at a cost which, when considered by itself, is low enough to compete with the muriates of Germany. Furthermore, in treating the ore for potash, the alumina and sulphuric acid are isolated and recovered as byproducts at practically no additional cost; or, looked at from the other angle, it has been demonstrated that, when primarily treated for the recovery of alumina, the potash and sulphuric acid appear as byproducts, and at no additional cost.

A graphic representation of the products that can be made from alunite appears in Fig. 1.

Paul J. Fox, engineer of the Florence company, formerly with the U. S. Department of Agriculture, has calculated the commercial possibilities existing in a ton of alunite at actual prices for some of its products in graphic form as shown in Fig. 2. Here each horizontal line represents a separate and distinct utilization of the component parts of a ton of alunite. The prices are those of December, 1922.

The Florence company has reached the conclusion that, to work for the commercial recovery of potash sulphate, alumina and, possibly, some of the salts will be enough for the present. The recovery of other byproducts will be a matter for later consideration.

The potash situation in this country is ripe for a reorganization. Prior to the war practically no potash was produced here. In reviewing the potash situation in the *Journal of Industrial and Engineering Chemistry* (September, 1922), Dr. John E. Teeple, who is the consulting chemist for the American Trona Corporation, stated that, from a production of practically nil in 1915, it reached a maximum of 54,000 tons of K_2O in 1918. Dropping back to 32,000 in 1919, it rose again to 48,000 tons in 1920. By 1921, Dr. Teeple says, fewer

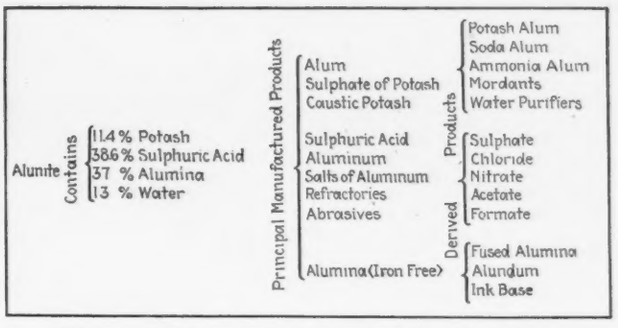


Fig. 1.—Diagram showing products of alunite

than twenty of the 128 plants that started out so bravely during the war were operating, producing only about 8,000 tons in the whole year. At the present time, December, 1922, there is said to be but a single American company producing potash—Dr. Teeple's own company, at Searle's Lake, California. Dr. Teeple pays his respects to alunite in the above article, which we quote:

"The alunite beds of Utah have been receiving a good deal of attention from both promoters and technical men.

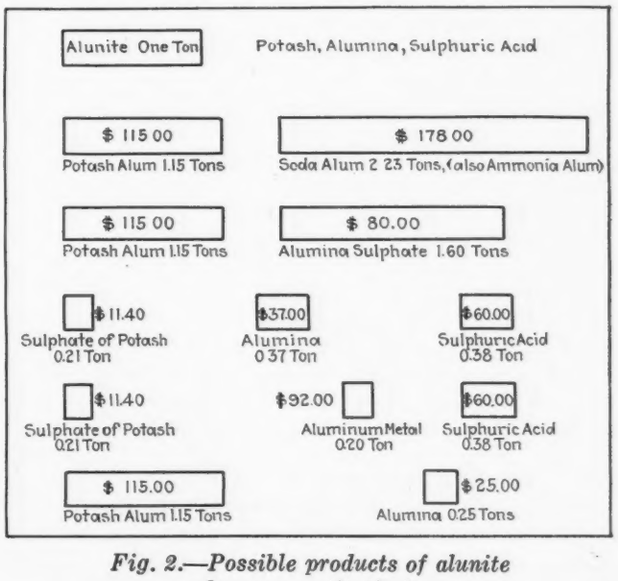


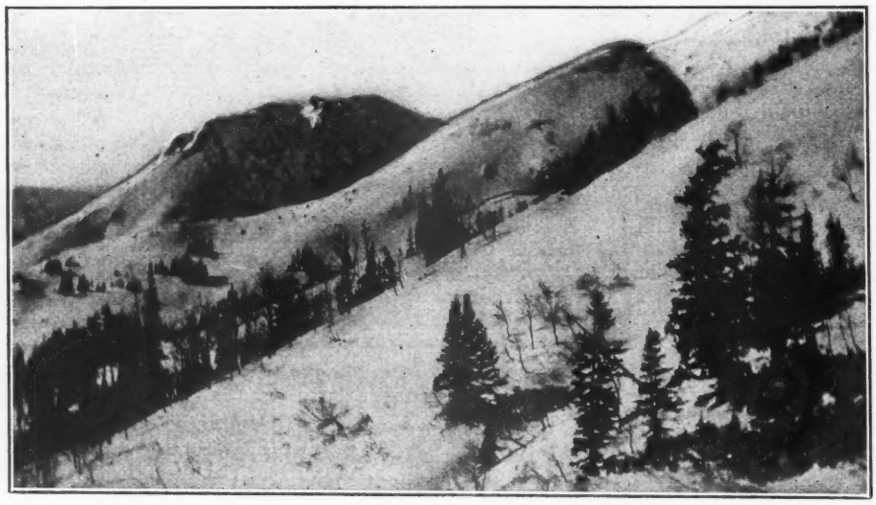
Fig. 2.—Possible products of alunite shown quantitatively

The manufacture of potash and alumina or aluminum salts from alunite is a perfectly feasible operation. When someone is willing to spend the time and money necessary to get systematic information and work out manufacturing details this should be a real part of our industry. If anyone has done this up to the present it has not become a matter of public knowledge. The prospectuses that happened to be presented to me so far have consisted of partial information and half-baked details. One large company seems to be making real progress."

Since last September, however, alunite has emerged from the position of "half-baked details"—indeed, it

had done so before that time, though Dr. Teeple probably did not know it.

The fertilizer manufacturers have now combined and have entered into long-term contracts with the German syndicate for their muriates of potash at prices close to pre-war levels. This action effectually shuts out all American competition except from those who may be able to produce their potash (sulphate) from alunite.



Tushar Mountains, where large deposits of alunite are found

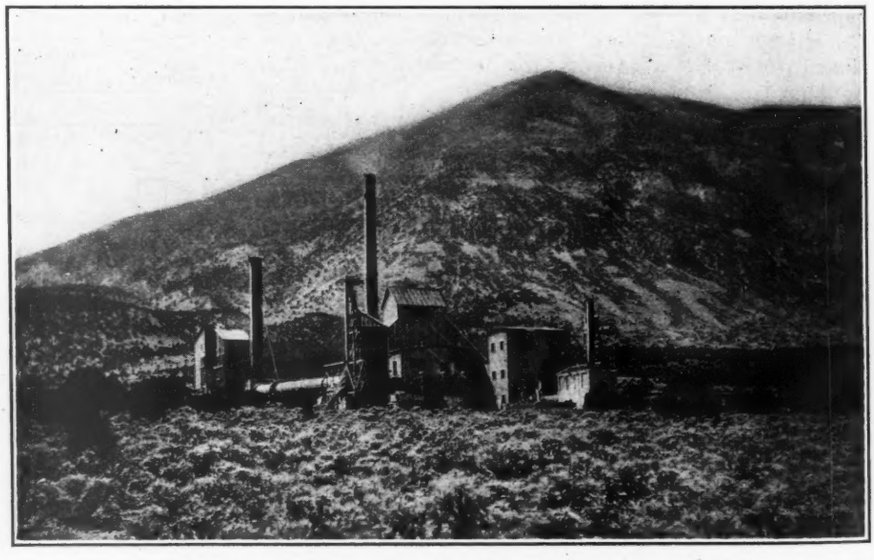
Alunite owners, however, declare that their sulphate is worth 25 per cent more than the German muriate, and they feel that they can produce K_2O, by virtue of the valuable byproducts, at a price that will enable them to compete with the foreign product.

Alunite will some day enter into direct competition with bauxite in the production of alumina. As long ago as 1915 the U. S. Geological Survey reported, in its Bulletin 620K, that "Experiments on the direct extraction of alumina from high-grade alunite have shown that the process works well and may be a commercial success if freight rates from Utah to eastern aluminum manufacturing plants are not prohibitive. As an offset to freight rates, however, is the fact that alumina produced from high-grade alunite is purer than from the bauxite ores of the Southern States."

Pure alunite contains 37 per cent of alumina, the latter containing about 53 per cent of metallic aluminum. Bauxite ores —the only known economic source of alumina—contain about 50 per cent alumina, or approximately 26.5 per cent aluminum, the remainder being silica, iron, and other compounds. None of these impurities are of commercial value, and they must be eliminated at a considerable cost. It is well known that the supply of bauxite in the United States is by no means inexhaustible. It is this fact that had led the alumina producers to purchase bauxite in other countries, and institute exhaustive search, the world over, for additional deposits. With the advent upon the market of alunite alumina there will be no need for worry about the future supply of alumina for several generations, at least.

Congress has not yet decided to turn Henry Ford loose at Muscle Shoals, and none can predict what disposition will ultimately be made of the offer. Mr. Ford has many reasons for desiring to obtain control of this property. Many of them have already been made known through the hearings of the Congressional committees to which the matter had been referred. It is not generally known, however, nor was it brought out at the Congressional hearings except by inference, that Mr. Ford intends to use alunite at that plant, if the United States sees fit to let him have it. His plan comprehends the use of alunite to produce potash for the farmers, aluminum for his and other factories, and many of the other byproducts and derivatives of the mineral.

Long ago Mr. Ford learned of alunite, and his engineers have followed the experiments on that mineral closely. Becoming convinced that the experimental stage had been passed and that the commercial recovery of potash, alumina, and other products was now assured, he at once became interested in alunite as a feature in his plan for operating at Muscle Shoals. It was alunite that Mr. Ford had in mind when he promised Congress that he would supply the farmers with a cheaper potash than they had ever had before, at a cost of but 8 per cent profit to him. His engineer, William B. Mayo, told the Congressmen and Senators that Mr. Ford would be able to do this, because the potash (sulphate) he would supply would be a byproduct obtained while producing aluminum for his factories. The Congressmen knew of no substance in nature from which both potash and alumina could be derived. They knew of no other source of alumina than bauxite, and, for



Alunite reduction works in the Tushar Mountains

some reason, Mr. Mayo left them in the dark and said nothing about alunite.

Apart from the fact that alunite is the only substance in nature that will perform the dual office described by Mr. Mayo, and that, therefore, it *must* have been the mineral to which he referred, it has since gradually leaked out that this is a fact—a fact of sufficient importance to throw more or less consternation into the camp of the producers of alumina from bauxite, of the German syndicate that, apparently, has sewed up the American market with its potash muriates, and of the manufacturers and producers of that great variety of other byproducts I have already mentioned.

The great mass of alunite in the Tushar Mountains is unique in itself and offers definite economic opportunities because of its purity. It is true that there are other sources of so-called alunite in the United States that have been exploited since the interest in that mineral has become general. In none of these, however, has high-grade alunite been found in large deposits. Among owners of such deposits may be mentioned the Utah Potash Co.; the Utah Fertilizer & Chemical Co., with claims near Balknap, Utah; the Pittsburgh-Utah Potash Co. controlling deposits at Deer Creek Canyon, near Sevier, Utah; the American Flag Potash King; the Copper-Butte Potash Co.; the American Smelting & Refining Co., owner of the Yellow Jacket claims near Twin Peaks, in the Marysvale district, Utah; and the Alunite Company of Nevada, whose deposit is near Sulphur. These companies have done some development and experimental work, unfortunately without satisfactory results, because of the low alunite content and the expense of eliminating the impurities.

Before the discovery of American alunite, chemists and metallurgists knew the mineral as an Italian product, mined in the vicinity of Tolfa. The largest of these veins, near Providenza, has been worked to a depth of 300 ft. These deposits, known and worked since the thirteenth century, have their chief value in Europe as producers of alum, which enters the market in competiion with the artificial alum of commerce. The Italian alunite, however, is believed to be too small in volume, too scattered, and of too poor quality to compete with the pure product of Utah.

In Australia several alunite veins have been discovered by gold miners, near Bullahdelah, in New South Wales, and near Warentown, in South Australia. In every instance the supply is limited and the grade poor except for the production of alum.

Phosphate Along Red Sea Coast of Egypt

Although phosphate deposits have been discovered at many points in Egypt, those along the Egyptian coast of the Red Sea are the only ones of present-day commercial importance, according to a writer in *Commerce Reports*. "The deposits at Koseir, El Karn, El Hamama, El Sibaia, and Sofaga are known to be valuable," states the *Bulletin du Canal de Suez*. The last named (Sofaga, 18 miles from the coast) is being developed by an English company. The deposit is said to contain more than 58 per cent of tricalcate phosphate and to be of high value as a fertilizer. The mine, which employs about 2,000 workmen, ships its product to the coast by means of an electric railroad, and practically all of the product is being exported to Japan. Japanese and English steamers, having delivered Oriental cargoes in European ports, return through the Suez Canal in ballast, with a saving of 2.50 fr. per net ton in canal tolls, and load phosphate at Sofaga for Japanese ports. The annual production is estimated to be approximately 125,000 tons.

The deposits at Koseir and El Sibaia are being exploited by an Italian company, which exports the product to Italy. Phosphate cargoes shipped northward through the canal from this source amounted to 28,000 tons in 1919, 69,000 tons in 1920, 35,000 tons in 1921, and 8,000 tons during the first nine months of 1922.

Mining Otalite Near San Diego

BY EVA B. STILES-ADAMS

The oil-refining industry on the Pacific Coast will be given an impetus by a recent transaction which conveys to the General Petroleum Corporation title to a large tract of land, near San Diego, Calif., valuable for deposits of steatite. Steatite finds a most useful application as a refining medium for crude oil. The mineral in this particular deposit has been named otalite. Since the first of the new year the corporation above mentioned has purchased 640 acres, a part of Otay Rancho, just south of Paradise Valley, and east of San Diego. Experimental operations during the past year have proved the practicability of exploiting the deposit, and the aquisition of the new tract indicates the establishment of a large industry.

Otalite is mined without great difficulty, the finished product being valued at about $120 a ton. The deposit at the Otay Rancho will yield aproximately 3,000,000 tons. Otalite is found in layers, chocolate, white, and pink, and the thickness of the deposit varies from a few feet to more than 100 ft. It is 98 per cent soluble, and is considered far superior to fuller's earth for oil-refining purposes.

The pink otalite is the purest and is the only kind used by the General Petroleum Corporation. The white otalite is used extensively in the making of soaps, talcum powders, and cosmetics. Many tons of the white otalite were shipped in a recent month for manufacture of toilet powder. The chocolate otalite is gritty. Otalite is used in the making of pottery and the manufacture of antiphlogistian. It is mixed with white sugar for the making of confections and candy. The material also has another use, lately developed: as a facial clay employed by beauty culturists to remove wrinkles and to rejuvenate faces. The most important use for otalite, however, is in the refining of petroleum.

By the purchase of the tract of land containing the deposit the General Petroleum Corporation has practically acquired the control of the otalite output. There are deposits in Nevada, but they are of inferior grade. There are also deposits of otalite in Mexico of as fine a grade as that found on the Otay ranch, but, because of the lack of transportation, the product is at present inaccessible.

The mining operations conducted on the Otay tract start with the stripping of the top soil to expose the virgin deposit. The otalite is then taken out with pick and shovel. In the rainy season the substance becomes quite sticky, being of a soapy, clayey texture, and is handled with more difficulty than it is in the drier seasons, when it can be cut out with the picks and shoveled into the cars.

The Laws of Crushing

Kick vs. Rittinger—Tests With a Screen Discharge Ball Mill—Theoretical Considerations and Actual Results

By John Herman
Assayer Chemist, 339 S. Los Angeles St., Los Angeles, Calif.

John Herman

SIX YEARS of custom grinding, using a Herman screening ball mill on material varying in character from granite to insect powder, reduced to all degrees of fineness, has given me an opportunity to test the laws of Rittinger and Kick, both of which have been proved correct for certain conditions.

Kick's law assumed that it is as difficult to break a 1-in. cube of homogeneous material to ½-in. cubes as it is to break an equal weight of ½-in. cubes to ¼-in. Kick had proved this, for the initial break only, by dropping iron balls of different sizes from a height just sufficient to break the balls on an anvil. It required the same height of drop to break all sizes of balls.

Rittinger's law assumes that the energy required is proportional to the new surface produced. Therefore, it will require a geometrically increasing amount of energy to break a cube into finer and finer cubes. Algernon Del Mar proved this with cubes of cement concrete, having artificial lines of weakness; it took only four times the energy to break a 1-in. cube that it did to break a ½-in. cube. According to Kick's law, eight times the amount would be needed, instead of four. The accompanying chart shows the energy input according to Kick and according to Rittinger, using a 28-mesh product from a ¾-in. feed as a starting point for both plotted lines. The Rittinger line and the Kick line have been plotted, as well as lines based on actual operation with varying materials crushed to varying meshes. Insufficient space is available to indicate the behavior of all materials used, but the position is indicated.

Most of the tests were made with a mill 3 ft. in diameter and 15 in. long. In making the test, the material is screened automatically as soon as ground, and it is worthy of note that, on all fairly hard material of irregular shape, the screen analyses do not vary greatly, nor does the ratio between any one mesh and any succeeding mesh differ to any considerable extent. If crushed to a given mesh, a material such as granite will give a screen analysis showing that about 50 per cent, or a little more, will remain on a screen with half the diameter of opening, and about one-fourth will pass through an opening one-fourth the diameter of the original screen. This simplifies calculation, and gives an opportunity for direct comparison. Tests with a 300-mesh screen indicate that the foregoing conclusions hold far beyond the 200-mesh products. Experience has shown that actual crushing facts are more in accord with Rittinger's law than with Kick's law. Furthermore, the more efficient the grinding, the closer is the approach to Rittinger's law. In many cases the line representing Rittinger's law coincides almost exactly with actual operation. Rittinger's law may be said to represent the minimum power required for reducing material, and Kick's law the maximum.

Screen Analyses of Ball-Mill Products

	Granite to 35 M.	Quartz Ore to 28 M.	Quartz Ore to 35 M.	Sulphide Ore to 35 M.	Secondary Diorite to 4 M.	Secondary Diorite to 10 M.
On 6 mesh	....	....	....	....	31.0	....
8 mesh	....	....	....	....	23.8	....
10 mesh	....	....	....	....	15.2	....
14 mesh	....	....	....	....	9.1	30.8
20 mesh	....	....	....	....	6.4	22.8
28 mesh	....	....	....	....	4.5	15.2
35 mesh	....	31.2	....	....	3.0	9.3
48 mesh	31.0	22.4	31.5	40.1	2.0	6.3
65 mesh	22.5	15.3	22.5	26.4		4.6
100 mesh	13.9	10.2	15.0	10.5		....
150 mesh	11.2	7.1	10.2	7.5	5.0	....
200 mesh	7.4	5.1	7.0	5.0		....
Through 200 mesh	14.0	8.7	13.8	10.5		...

Either law may apply to the same material. If a 10-ft. bar of iron is pulled into two parts, it has to be stretched twice as far as a 5-ft. bar to break it; this is in accordance with Kick's law. If a bar of the same diameter is sawn into two parts it makes no difference whether the bar be 5 ft., 10 ft., or any other length. This is in accordance with Rittinger's law. The nearest approach found to Kick's law was on tough material such as secondary diorite, especially when the reduction ratio was small, as in the case of middling that was ground only slightly smaller. The highest efficiency was found in the screening ball mill when the ore was reduced through at least ten numbers of the Rittinger scale, as from ¾-in. feed to 28-mesh product. This is because energy transmitted from ball to ball is utilized on material that can still be broken by the decreased force of the blows. Steps in reduction in this mill should be large; when 2-in. material was ground to 3 mesh, and then ground from 3 mesh to 10 mesh, much more energy was needed than when the grinding was accomplished in one step. Others have found a small-step reduction desirable, because it was possible to suit the size of balls to the work to be done, thus more than offsetting the disadvantages; but this occurred with inclosed-type mills, where the product was decidedly variable and where big-step reduction was really occurring.

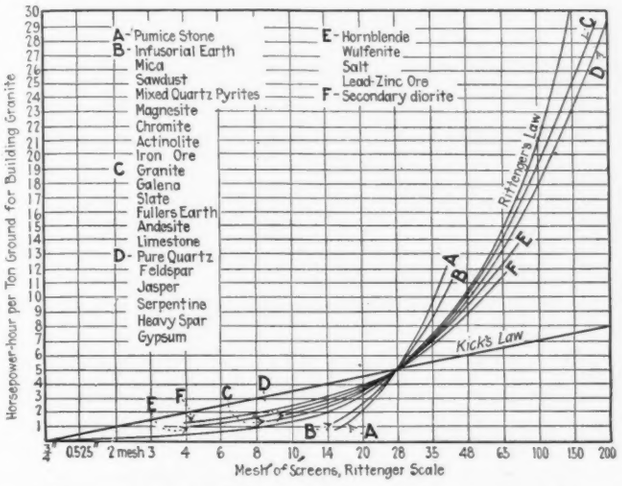
Theoretical considerations and practically tests alike show that, on homogeneous material, Kick's law applies to the pressure for the initial break, whereas Rittinger's law applies to the energy actually used in the fracture itself. To accept the invariable correctness of Kick's law, it would be necessary to assume a release of all the pressure as soon as the first fracture occurred. As a matter of fact, many fractures may take place without a loss of much of the pressure that caused the first fracture.

Nearly all material of interest to the metallurgist is unhomogeneous, and composed of more than one mineral. Usually, it is desirable to stop further grinding

when there are no more planes of cleavage. This is what is meant by "grinding just enough to free the mineral." For the foregoing reasons, Kick's law often fails for even the initial fracture. The chief reason for grinding is to separate particles of different characteristics, and this process follows Rittinger's law; the separation takes place along a definite plane, and the molecules must be separated a definite distance before fracture is effected.

In actual operation, initial fracturing is only one factor; the pressure is not released by the first fracture but often continues for many. In this case Kick's law applies to the first fracture and Rittinger's law to the one that follows.

In a test to prove Kick's law, using falling balls, the excess energy over that which caused the rupture is



Energy required for crushing various materials according to Rittinger, Kick, and experimental data

transmitted largely to the anvil; more will be transmitted by a large ball than by a small ball. The work of one falling ball in a ball mill may be passed through several balls. It was found that the ball mill did more work per horsepower than did a testing machine in which the balls were dropped on individual pieces of rock.

When ¾-in. diameter wood chips are broken, most of the energy is expended on breaking across the cells; the splitting apart of the cells takes little energy, hence in this case the mesh desired determines the number of breaks that must be made in a given length. Grinding to 10 mesh was found more than twice as difficult as grinding to 6 mesh; grinding to 20 mesh was more than twice as difficult as grinding to 10 mesh. The same facts apply where the breaking is virtually in two dimensions, as in grinding pure mica. With pumice, the grinding to the finer meshes was more difficult, proportionally, than was the grinding to the coarser sizes; beyond 60 mesh it was as difficult to grind pumice as it was to grind quartz. The grinding of granite was found to follow Rittinger's law closely.

Kick's law can be proved reliable in a few cases; but if a universal application is attempted its unreliability can be demonstrated easily. Thus, if it requires the same energy to break unit weight of 1-in. cubes to ½-in. cubes as it does to break ½-in. cubes to ¼-in. cubes, it would require an infinite amount of energy per unit weight to reduce an infinite cube to a given size; for each step would require the same energy as would each succeeding step, and there would be an infinite number of steps.

It is not necessary, however, to go to infinity to disprove the universal application of Kick's law. Counting a reduction to one-half the diameter as one step, it would require 26 steps to get 6-in. cubes from the whole earth. If the energy indicated by Kick's law were applied to one ton of granite exposed on the earth's surface, it would become red hot. No one will claim that it is 26 times as difficult to get one ton of granite from a flat place on the surface of the earth, and break it into 6-in. cubes, as it is to break 6-in. cubes into 3-in. cubes, or to grind from 100 mesh feed to 200 mesh product. As a matter of fact, the last operation requires many times the energy required by the first, instead of less than one twenty-sixth as much.

The fault is not in Kick's law, for the initial break by pressure, but in assuming that grinding occurs in consequence of compression of the entire mass and that the pressure necessary for the initial fracture is released as soon as this occurs, and in failing to take into consideration what happens to the energy left after initial fracturing. Rittinger's law can be proved in cases of sawing, planing, filing, channeling, boring, chiseling, scouring, peeling, and gouging. It is as easy to chip ¼-in. pieces from a flat surface of exposed granite as it is to chip them from the surface of a 6-in. cube.

Alsatian Potash Production a Record in 1922

According to the figures just published by the French Government, the production of potash largely increased in Alsace during 1922. It was, in every respect, a record year. The production of the Alsatian potash mines has been as follows:

	Raw Salt, Metric Tons	Pure Potash, Metric Tons
1913	355,341	58,000
1919	591,471	98,000
1920	1,222,615	192,480
1921	884,139	146,355
1922	1,350,000	230,000

From these figures it will be seen that the production of 1922, compared with that of the last pre-war year, more than quadrupled. The exports have also largely increased. They amounted, for pure potash (K_2O) in 1913 to 40,719 metric tons and in 1922 to 169,684 metric tons, as against 110,230 metric tons in 1921.

Occurrence of Mesothorium

Pure mesothorium has never been obtained, states the Bureau of Mines in Technical Paper 265. The product from monazite sand, even when fully as active weight for weight as radium, contains only about one-fourth of 1 per cent of mesothorium by weight, practically the entire mass being barium and radium compounds. Likewise specimens of mesothorium free from radium which have been prepared chemically from mantle ash are barium compounds, the quantity of mesothorium constituting a mere trace. Notwithstanding the minute mass in such preparations, its relatively rapid rate of decay imparts to them a gamma-ray activity comparable to that of radium. The custom has thus grown up of expressing the quantity of mesothorium not, as with radium, in milligrams by weight, but by its gamma-ray activity.

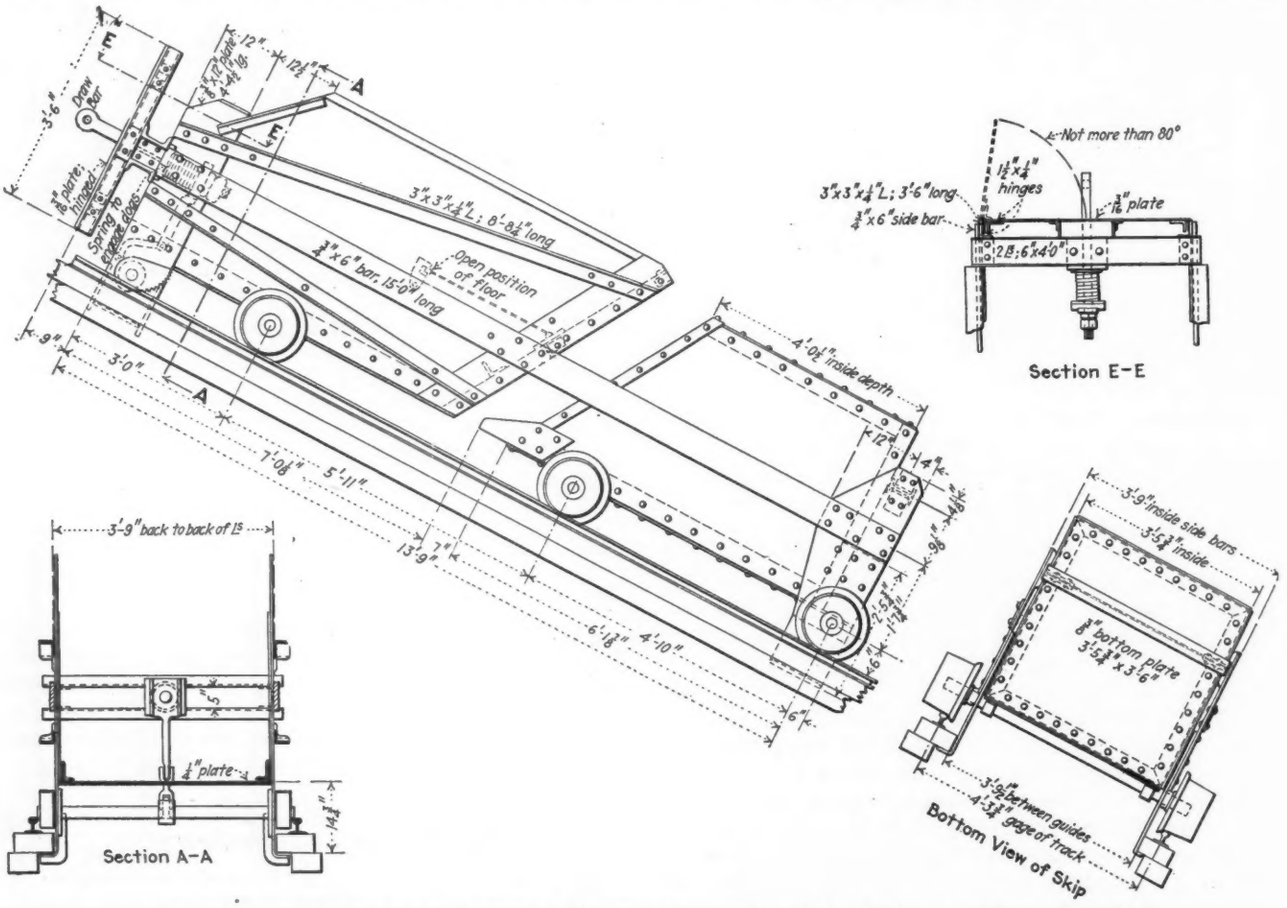
USEFUL OPERATING IDEAS

Safety Guides for Inclined Shafts

BY E. D. GARDNER*

Safety of operation is generally given the first consideration in modern-day mining practice, yet the skips used in many inclined shafts have no safety devices to prevent their falling if the hoisting cable should break. This unsafe practice is continued mainly because mining men on the whole are not familiar with satisfactory safety devices for the purpose. The Compania de Real del Monte y Pachuca, at Pachuca, Mexico, has solved the problem in a satisfactory manner and has devised efficient guides and dogs for use in its inclined shafts. The Rosario shaft of this company, which is thus equipped, is an incline of about 65 deg. slope and is used for hoisting ore to the tunnel level. It is also employed for handling men and supplies. A combination cage and skip is in use. The skip has a capacity of 60 cu.ft. The floor of the cage, which is horizontal, is folded back when the skip is used for hoisting ore. The track gage is 51⅜ in. The rails along which the skips run are spiked lengthwise on 4x8-in. timbers on top of 4x6-in. stringers, which in turn are fastened to cross-sills. Part of the 4x8-in. timber projects far enough over the 4x6-in. stringer toward the center of the shaft to be used as an ordinary shaft guide. Eight by eight-inch stringers may also be used, and 4x6- and 4x4-in. guides be bolted on the inside. Safety dogs, even with the top of the cage and similar to those used in vertical shafts, are used on one side of these guides, with a shoe opposite the dog, and on the under side of the guide. The dogs on each side of the cage are provided with wheels, which run along the top of the guides and prevent binding. The shoes, which are attached to the axles by angle irons and run under the guides at both ends of the combined skip and cage, prevent the skip being derailed or raised off the guides when the dogs are released. A rod inside of a powerful coil spring, and to which the hoisting cable is attached, extends about 2 ft. below the bonnet of the cage. If the pressure on this spring is suddenly released, as by the breaking of the cable, the spring pulls down the rod, which, through two toggle bars, causes the guides to be gripped between dog and shoe, holding the skip.

The arrangement described has given satisfaction in the operation of the combined cage and skip. The safety device is positive in its action, and tests show that it is efficient for the purpose.



General arrangement of combination skip and cage, with safety device to prevent dropping

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THE PETROLEUM INDUSTRY

Another View of Article 27

By C. A. Grabill

IN THE ISSUE of Feb. 10 there appeared an article by R. B. Brinsmade entitled "The Subsoil of Mexico and Article 27." Mr. Brinsmade should remember that historical argument depends entirely on the date selected as a starting point; thus one can prove Alsace and Lorraine either French or German, depending on whether one elects to begin with the time of Caesar or that of Charlemagne, Carlos V, or Napoleon the Great.

Mexican law is founded on old Spanish law. Rockwell says that the first known Spanish code is a decree of Alaric the Goth, directing the observance of the Roman Code. After this decree, numerous decrees and legal recognitions of rights and customs appeared, which were finally compiled and issued as the New Code (Nueva Recopilación) in 1537. This was added to and reissued under the same title in various editions until 1777. There was also a body of legal decisions and miscellanea which was called the "Siete Partidas." In 1761, Don Francisco Xavier de Gamboa published with the king's approval an addition of the Nueva Recopilación, adding thereto his own opinions on each subject. This is known as Gamboa's Commentaries, and has almost, if not quite, the authority of law. In 1783, the King of Spain approved the code, to which Mr. Brinsmade refers, known as the "Ordinanzas." In 1805, the Newest Code (Novísima Recopilación de las Leges de España) was approved. From this date until 1821, the date of Mexican independence, there were various amendments.

The Ordinanzas was specifically planned for Mexico. That it classed petroleum as property of the Crown is clear. Titulo V states that the original title to all mines rests in the Crown and that without being separated from the Royal Patrimony, they may be given into the possession of individuals under the condition that the mines shall contribute a specified portion to the royal treasury and that they must be worked continually, except as provided.

Mr. Brinsmade selected an excellent starting point, but there are several questions. "How come" this code and why? Is it all of the law and the prophets, and were they happy ever after? There is no inherent quality in mineral deposits by virtue of which they must belong to the nation or the Crown, any more than there was such a quality in all land when it was regarded in that light in feudal times. It is merely the public's opinion reflected in the acts of its rulers as to the method of handling the matter which will result in the greatest benefit to that public. Going back to Roman law, the foundation of Spanish law, we find that mines of gold, silver, copper, iron and "steel," lead and others belonged to the proprietor of the land in which they were found. But mines were too good a thing to be overlooked by the despotic Roman emperors, so first they put a 10 per cent tax on the gross output. Later comes a Spanish law which enumerates as among the things that belong to emperors and kings "all taxes (rentas) of mines of iron or other metals." Note that it was the taxes, not the mines, which belonged to the king. The kings were progressing. By the time of Don Alfonso XI the law read "all mines of gold, silver, lead or any other metal belong to the king and may not be worked without his mandate." This was going too far, and the tide swung back for awhile; but it ebbed and flowed, depending on conditions, just as it is doing today.

It must not be thought that the course of events was as smooth as above outlined. It seems to follow a regular cycle, varying in detail according to the morals, customs and economic conditions of the times, but in general is as follows:

First, a period of depression in the mining business corresponding to a period of general hard times.

Second, something must be done to help the mining industry. It is relieved from taxes, concessions are granted freely to encourage operation. Aid in many forms is promised and sometimes granted.

Third, mining picks up and the government finds that it will stand a little taxation.

Fourth, boom times. Miners make large profits and the politicians find that their predecessors exceded their authority in granting concessions, and so revoke them and grant new ones at a price as high as the traffic will stand, the authority to grant the new concessions being on just as sound a basis as in the previous periods.

Fifth, the burden comes too great and the industry reverts to the condition of the first period.

The first period was responsible for President Gonzalez, the second for President Diaz. During the closing years of the latter's administration, conditions became those of the third period, and when he failed to recognize the fact he was compelled to leave the country. Thus the third period was responsible for Madero, and Carranza merely took advantage of the fourth.

Trying to trace the legitimate successor to the subsoil rights of the Spanish Crown through this chaos is like trying to trail a bootlegger through the streets of New Rotterdam on a dark and foggy night. One can find precedents for almost anything, legal and otherwise. Finally the Constitution of 1857 appeared, which lasted until 1917. Maximilian's reign was an interregnum and not recognized, and his acts have no value as precedents.

All powers not specifically granted to the Federal Government by this instrument were reserved to the separate "free and sovereign" states. Nothing was said in it concerning ownership of the subsoil rights, and they were vested in the states. Several states drew up their own codes and the Supreme Court ruled that the states had the right to legislate on the subject.

Thus we arrive at the year 1883. What I wish to point out is that events were following the cycle already

described; that the various legislators were controlled by public opinion and could only hasten or delay, but by no means change, the course of events, and that technical legality was a secondary matter, as it often is. During the long period of revolution, war, insurrection, and robbery and violence of every kind, the mining industry had almost disappeared, and at the date mentioned was clearly in the condition of the first period.

The importance of the mining industry was, of course, well understood in a mining country, and public opinion was demanding that something be done about it. Obviously, the beginning of the second period.

Conditions were such that on Feb. 5, 1883, a commission was appointed to recommend what should be done to re-establish the mining industry. It reported that the laws should be unified and coded, and that the industry should be freed from various taxes; that statistics and information be published concerning coal, petroleum, mercury, timber, and water; that foreign capital should be exempted from taxes for a term of years and everything should be done to encourage it.

At this point, however, Congress ran into an obstacle. The Constitution gave it no power to act. The matter was urgent, so an amendment was drawn up which, when ratified by nineteen states (the necessary number), became "Article 72," in which it was stated that 'Congress had power to enact codes, obligatory throughout the republic, for mining and commerce, the latter including banking.' Congress immediately passed the code of 1884 as drawn up by the commission.

If, to use Mr. Brinsmade's term, Congress was "depraved," then the country must have been in a shocking state; a depraved Congress and a depraved commission, a depraved president and nineteen depraved legislatures and a depraved Supreme Court and nobody to protest. I prefer to believe that Mr. Brinsmade is mistaken and that the action of Congress was taken for the reasons stated by the commission, and impelled and endorsed by public opinion. I will admit that one may quibble about a number of technicalities: there is nothing to show that title to the subsoil had passed from the state to the nation, and I do not believe that such was the intention. It was specifically stated that the taxes were for the states and then another clause says that "the Federal Government will receive 25 per cent" of the amount collected by the state.

This code, in the main, followed the Ordinanzas, the principal difference being that it divided mineral deposits into two classes (speaking in a general way), metals and non-metals, the title to the latter being specifically vested in the proprietor of the surface where found and nothing said as to title to the former.

Mr. Brinsmade, apparently quoting from "Legislación Petrolera Mexicana," which, by the way, is an *ex parte* brief prepared by the Carranza Administration to bolster up Article 27, says that the Congress had no power to make this declaration. I would point out to him that the amendment under which this code was authorized was specifically prepared to legalize this identical code, and that its terms were accepted by all parties concerned, including the legislatures of twenty-odd states, and remained unquestioned, being repeatedly indorsed and confirmed for over twenty-five years until the industrial cycle reached the fourth period.

To understand the legislative action of that day one should endeavor to get a general view of the economic conditions of the time. In 1884 Mexico was just recovering from a revolutionary debauch which had lasted for about seventy years, and, as previously stated, the country was in a deplorable condition. It was believed, and I think correctly, that the national welfare depended on the revival of mining and transportation. To improve the latter, concessions and even subsidies were granted, but treasury receipts were less than the expenses of government. Petroleum deposits of importance were practically unknown, and owing to the lack of transportation facilities, the value of coal and saline deposits depended entirely on the demand in the immediate neighborhood, and this, due to the condition of the mining and manufacturing industries, was practically nil.

To aid these industries, and, above all, silver mining, it was desired to make mining supplies as cheap as possible. It was thought that this was best accomplished by removal of all governmental restraint from the production of fuels, quicksilver, iron salts, and building materials. The simplest way seemed to be to place all non-metals in the ownership of the proprietor of the soil. The exceptional nature of the Mexican petroleum deposits was at that time entirely unsuspected. How was this any more dishonest than the granting of homesteads and water rights in our own United States?

In June, 1887, all federal, state, and municipal taxes were removed from coal, petroleum, iron, quicksilver, and their products for fifty years. This also failed to accomplish the desired result, and in 1892 a new code, differing radically from the Ordinanzas, was drawn up and promulgated. It is obvious that Mr. Brinsmade misunderstands Article 4. It was understood that ownership of non-metal deposits had passed to the surface owner. Neither state nor federation had title or interest in them, but Congress did have power to regulate their operations. Article 4 merely says that no license to operate was required; at least, so it was understood in subsequent years. My opinion is confirmed by the code of December, 1901.

The code indicates that the finding of petroleum seemed so advantageous to the country at large that the government was offering a special premium for its discovery on government land, which might seem so attractive, even to those who owned possible fields outright, that they might desire to take advantage of the new offer instead of continuing to hold their lands in fee.

Finally the code of 1910 was promulgated. Mr. Brinsmade rather froths because the Congress of 1909 still stood by its contracts and repeated the statement that petroleum deposits belong to the surface owner. He omits to call attention to one important proviso, which was, I believe, the reason for this repetition considered unnecessary in 1892. That proviso is that deposits of gold and silver, etc., belong to the nation. The presence of this statement required the presence of the corresponding one to the contrary concerning non-metals.

When the code of 1892 was promulgated, the country was in the last stage of the second period, and the policy of the Diaz government which produced this and other similar measures was thoroughly endorsed by the country at large, and its success resulted in his great popularity. In 1910 the country was entering the fourth period, and reiteration of the same policy was unpopular.

Article 27 is likewise legal, if the present government stands. Any primary law adopted by any country is legal. But its justice and morality are entirely different matters. In 1917 the country was in the fourth period. The petroleum fields had been developed far beyond the dreams of 1892 or 1901 and offered opportunities of aggrandizement too great to be resisted.

SOCIETIES, ADDRESSES, AND REPORTS

Canadian Institute Convenes at Montreal

Dominion's Fuel Problems Principal Topic of Discussion—Mathewson Details Plans for A.I.M.E. to Tour Canada—J. A. Dresser Elected President

BY ALEXANDER GRAY

THE TRANSACTIONS of the Canadian Institute of Mining and Metallurgy, in the twenty-fifth annual meeting at Montreal, on March 7-9, were accompanied by the usual technical papers and displays of fraternal spirit—that fellowship which alone justifies such gatherings in countries of "magnificent distances." Perhaps the range of topics dealt with was not so varied. In the main the papers constituted what was devised as a symposium on the coal issue.

Statistical data emanating from Dominion and Provincial Departments, contained the concrete evidence of revival, if not substantial progress in the mineral industries, only coal being laggard. Optimism was the keynote of these official documents. What unrest was reflected in the figures and the papers submitted, relating to Canadian fuels, really was constructively designed. Being fully informed, the Institute resolved on the initiative of Dr. C. V. Corless and Mr. Balmer Neilly, that the Dominion Fuel Commission be augmented by adding recognized economists or such other specialists as may be necessary to the intelligent disposition of a vexing question. In reality this was the most important action taken by the Institute. The West and the East joined on behalf of their coal resources; Ontario and Quebec heartily concurred. It rests with the Dominion Government, the railways and consumers to find a common ground and provide larger markets for Canadian coals.

There has been an impression that sectional interest and organizations—provincial in their adopted spheres—might detract from the Institute as a national organization. The Montreal meeting has disproved this to some extent, and the credit for the fusion of purposes within the Institute is given to President W. R. Wilson, an outstanding personality, the executive of Crow's Nest Pass Collieries and one of the owners of the Premier gold mine, in British Columbia. His western catholicity and world-wide experience in mining affairs in the Old Country, Pennsylvania, British Columbia, South Africa and Ontario; his comprehension of what is involved in current world movements, lent force to his policy of cohesion. The Institute, he has insisted, must be coordinated to every section, its welfare being the first order of business. Of the future of Canadian mining he entertains the most optimistic view, and he has held that the Institute should share proportionately in the responsibilities and prospects. Whatever will strengthen the organization had and will have his support. As a neat manifestation of his abiding good-will and modesty withal, one of his final acts in the seclusion of the Council chamber was to draw his cheque for four figures and demur to publicity as to it. He would have others follow his example—his position is that whatever will forward his fellow scientists will further mineral industries. So salutory has been his administrative and individual acts, the Council of the Institute felt complimented in bestowing upon him an ornamental testimonial, with all the good wishes intended to accompany it. These incidents, in camera, the bestowal of mutual felicitations at the closing banquet, the intermediate luncheon and at the concert jollification, are of happier augury for the term of the incoming president, John A. Dresser, who has the elements of popularity and the capabilities requisite to the solidification of the Institute.

MONTREAL PROPOSED FOR NEXT MEETING

As an illustration of the spirit pervading the meeting, there was unanimity when by a *viva voce* vote it was unanimously recommended that the incoming Council of the Institute hold the next gathering in Montreal. The further suggestion, made at the smoking concert, was that this pre-arrangement be made permanent. No briefs were filed, nor arguments made. The solitary interpolation, jocularly interposed, was that if Montreal is to become the perennial rendezvous, it might be advisable to make an appropriation to cover the wear and tear on the front steps of the Mount Royal hotel, owing to the heavy traffic toward and from a convenient Provincial laboratory. The international guests registered their concurrence in these decisions when, at the smoker, they had the liberties and luxuries of an all-around season, without fear or favor.

Mr. E. P. Mathewson, who prided himself upon being "the first Canadian-born President of the American society," found opportunity at the banquet of the Canadian Institute to take sides with the official *Bulletin* as against the *Canadian Mining Journal*. "They," he said, (meaning the *Mining Journal*) "have tried to steal your birthright and substitute for it a mess of pottage." Opinion being divided as to the wisdom or necessity of having the *Bulletin* conducted at a loss and attempting to compete with the *Journal* for advertising—where there is not enough advertising to sustain either undertaking—the remarks of Mr. Mathewson were somewhat of a reiteration of what has been said elsewhere on similar issues, in the United States and on the Rand. "Stealing" hardly is the language of diplomacy—and as for the "mess," as Mr. Mathewson put it—it consists of an Institute deficit and the inability of the *Journal* to pay its way without the support of affiliated publications. The matter of this drain upon the finances of the Institute came up through a proposal that differences be adjusted and the *Journal* devote special space to the affairs of the Institute. It is an old controversy—and a losing one on both sides—and the members are aware of this. Mr. J. J. Harpell alleged that the deficit of $10,000 in the Institute balance sheet was due to the publication of the *Bulletin*. On the other hand, it was maintained by Secretary Mackenzie that this deficiency is not wholly attributable to the *Bulletin*. Mr. Mathewson spoke figuratively, of course, but thieving of "birthrights" is not a one-sided proposition. Moreover, there is evidence of disintegration where cohesion is more than ever essential to the Institute. Otherwise additional sources of revenue will have to be sought by the Institute. A not dissimilar situation prevails in regard to professional and non-professional members. In his valedictory, President Wilson urged the propriety of outside contributions by those identified with mineral industries. This phase of affairs and that of the *Bulletin* publication, will be further considered.

AMERICAN INSTITUTE TO TOUR CANADA

The presence of President Mathewson and Mr. Bradley Stoughton, of the American Institute, was more than a courtesy call. They aim to establish a closer bond with affiliated societies. McGill being Mr. Mathewson's alma mater, Canada finding gratification in having him chosen to be the first Canadian President of the American Institute, he was warmly greeted, Mr. Stoughton sharing the welcome. Mr. Mathewson discussed his plan to have the American Institute make an exten-

sive summer tour through the mining districts of Ontario and Quebec. As yet, his arrangements are tentative. They are advanced sufficiently to have the Canadian Institute formally invite the American Institute to come and be sociable, with the courtesies of the country. By special train, the itinerary, as provisionally decided on, includes a stay at Toronto, where there will be a midsummer meeting and brief discussions. From there, it is intended to go for a day or two to the nickel-copper mines. Two days will be devoted to the Porcupine gold mines. Returning, a call will be made at the power, pulp and paper plants of the Abitibi company. Thence, the party will proceed to the Kirkland Lake gold producing district; to Cobalt; the Keeley mine at South Lorrain; Ville Marie as a typical French-Canadian center, and on to Montreal. The outing will terminate with a trip to the asbestos mines of the Quebec eastern townships.

Should Mr. Mathewson consummate the arrangement, the hospitalities of the northland will be extended as and when possible. All who were consulted indicated their approval of the excursion—because of the beneficial effect it will have in affording first-hand knowledge of the potentialities of the respective districts, the Ontario sections having accounted for minerals to the value of about $850,000,000.

The Coal Complex

Every phase of Canada's fuel problem formed the chief topic of technical discussion. The consensus of opinion embraced in the papers presented, as expressed by Dominion and Provincial authorities, and as indicated by operators and fuel conservators was that Canada must consume more of its own products and reconcile costs to added consumption. The West vigorously contended that it is being excluded from its natural markets by excessive railage and unfair competition. Papers by B. F. Haanel on "The Fuel Situation in Canada" and "Peat Resources of the Central Provinces and Their Utilization for Fuel Purposes"; by J. F. Brown on "The Relationship of the Anthracite Fields to Canada"; by R. J. Lee on "The Lignites of Saskatchewan," and by G. B. Saunders on "The Problem of Replacing Foreign Coals on the Manitoba Market," were followed closely throughout several sessions. Upon one point all the Canadian speakers were agreed, that existing conditions are intolerable, that Ontario is isolated under prevailing circumstances from Alberta and Maritime Province coal, and that coke and adjacent lignites may be a partial solution of existing difficulties.

The Haanel conclusion is that Ontario should look to the bituminous coals of the United States. Quebec having the means whereby hydro-electric energy and coke from Nova Scotia coals can be made use of, Mr. Haanel argued that "Ontario must depend upon her supply on the United States," where "the resources of bituminous coal are still so great that for all practical purposes they may be regarded as far from depletion." But in pursuing this subject, Mr. Haanel touched the tender spot, where Alberta is so sensitive. "Moreover," said Mr. Haanel, "the bituminous coalfields of the United States are overdeveloped and are capable of producing, and do produce, far more coal than is required for home consumption. Hence a foreign market will always be sought for the excess production." Consequently it is feasible to coke imported bituminous coal in by-product ovens, centrally situated, and thereby serve Canadian consumers while substituting the coke for high cost anthracite. Otherwise, it is acknowledged by Mr. Haanel, that "western coals, though suitable for domestic and industrial purposes, cannot be delivered in Ontario and Quebec at points further east than Port Arthur," on account of "the exceedingly high cost of haulage" from mine to market. "It is not conceivable," Mr. Haanel reckoned, "that railway operation can be so improved as to make possible the haulage of coal cars over a distance of 2,000 miles, with a return journey of empty cars, and at a cost that that would permit this coal to be placed in the consumers' cellars in Toronto and Ottawa in competition with American anthracite and bituminous coal."

The general tenor of the remarks of others on the coal problem was that Canada must solve it. George B. Saunders, of Winnipeg, charged that "American interests" there had tried to damage the reputation of domestic coals by "selling the most inferior grades under the label 'standard Canadian coal.'" He claimed "there is a Canadian coal suitable to every type of heating plant, whether steam or domestic." Alberta coal could be landed at upper lake ports for $9.50, or thereabouts. In rejoinder to Mr. Saunders and the Albertan view, Mr. J. F. K. Brown, chief engineer of the Hudson Coal Co., of Pennsylvania, gave cold comfort to Canada. He maintained that the probable life of the Wyoming Valley field, which supplies most of Canada's coal, is but thirty-six years. The coming of worse times for coal-buying Canadians is as sure as the immutable laws of the universe, Mr. Brown argued, and he further contended that "attempts to render Canada self-sustaining in the matter of coal are foredoomed to failure." Mr. W. J. Dick reviewed coal activities in Alberta and British Columbia; President Wilson advocated the provision of coking plants. Mr. George H. Cushing, of Washington, in behalf of American interests, suggested the greater use of water routes. "Coal markets are hard to get," he admitted, "and we are not going to surrender the 20,000,000 tons of business with Canada without a fight." If Alberta cut its coal price 25 cents, America would cut hers 30 or 50, and if the British coal dealer cuts his price a dollar, America would cut $2.

Dr. C. V. Corless, of the Mond Nickel Co., declared that the people of Canada owned the railroads and should have a right to say what they should do. It was no use to talk around the subject. The coal is in one place; the need for it in another, and they had the railways to carry it. If Canadian mines were developed it would mean keeping $100,000,000 a year in Canada, while in twenty years Canada will require a hundred million tons of coal a year. The United States, while maintaining the best relations, was a competitor nation. They were sitting on American coal and iron and steel, and it is a dangerous situation that the government ought to face.

F. L. Wanklyn, Executive Assistant to the president of the Canadian Pacific, and one of the members of the Quebec Fuel Advisory Board, was more emphatic in his remarks. If they were ever to be a nation they had to control their domestic fuel supply, and they should get their best brains among the citizens applied to the solution of the problem. It was impossible, he said, for a nation owning 17 per cent of the world's known fuel supply, with a tenth of one per cent of the world's population, to sit with her hands crossed and say it was a commercial question. That they could not solve it was simply non sense. The matter should be taken hold of in the most earnest way, for they had to bring about some change. In Virginia they hauled trains of 80 and 100 cars with special engines, because they applied brains to find out in what manner it could be done. Mr. Wanklyn asserted the people should be educated to use coke.

Of the miscellaneous subjects discussed during the sessions of the Institute, Mr. Clayton D. Dean was most interesting in his narrative description of "Fuel Oil as an Aid to Civilization." Professor Haultain on "Kick vs. Rittinger." Fred H. Williams gave his "Notes On the Welding of Iron and Steel With the Electric Arc"; J. W. Evans on "A Preliminary Prospecting Trip in Northern Quebec," and H. A. Burbank's story on the "Evolution of Rock Drilling" was very highly commended.

Engineering Council of Utah Elects J. F. Merrill President

Dr. Joseph F. Merrill, director of the School of Mines of the University of Utah, was elected president of the Engineering Council of Utah to succeed H. T. Plumb at the annual meeting of the governing board, held March 3. The Council which was organized three years ago to form an affiliation of the various branches of the engineering profession represented in Utah, takes in about 1,400 men. The governing board is made up of representatives elected from the membership of the different organizations which go to form the Council. The members of the present governing board are: H. T. Plumb, J. F. Merrill, R. K. Brown, W. E. Ware, P. P. Ashworth, H. M. Adkinson, E. R. Pembroke, G. F. McGonagle, and H. C. Means.

Three New Members on Colorado Metal Mining Fund Board

Governor Sweet has appointed as members of the board of directors of the Colorado Metal Mining Fund for the ensuing six years, Robert A. Sayre, of Gilpin County, A. L. Blomfield, of Cripple Creek, and R. M. Henderson, of Breckenridge. Mr. Sayre is largely interested in mining properties in Gilpin County, Mr. Blomfield is manager of the Cresson mine and the Golden Cycle mill, and Mr. Henderson is manager of the Wellington Mines Co.

The board is composed of nine members, representing the various mining districts of the state, who are appointed for a term of six years, the terms of three members expiring at intervals of two years. Bulkeley Wells is chairman and M. B. Tomblin is secretary.

Fifth Pan-American Conference at Santiago, Chile

The Fifth International Conference of American States, commonly called the Pan-American Conference, will open at Santiago, Chile, on March 25. It is a sequence of the Pan-American movement which was initiated by the meeting of the first conference at Washington in October, 1889, and which was carried forward by the conferences held at Mexico City, Rio de Janeiro, and Buenos Aires respectively. The government of Chile invited Secretary Hughes to be its guest at the conference, and he accepted subject to the contingency of his official duties keeping him in Washington. President Harding named eight delegates to represent the United States as follows:

Henry P. Fletcher, of Pennsylvania, Ambassador to Belgium and former Ambassador to Chile; Senator Frank B. Kellogg, of Minnesota; Senator Atlee Pomerene, of Ohio; Senator Willard Saulsbury, of Delaware; Dr. George E. Vincent, of Connecticut, president of the Rockefeller Foundation; and Frank E. Partridge, of Vermont, former Minister to Venezuela.

The program of the conference includes the following:

Pan-American agreement on the laws and regulation concerning, and co-operation in the improvement and facilities of, communication on ocean, on land, and in the air. This includes improvement of ocean transportation facilities, the Inter-Continental Railroad and motor transportation; policy laws and regulations concerning commercial aircraft, and co-operation of governments as to wireless communication.

Co-operation with respect to the supervision of merchandise entering into international commerce, this covering the uniformity of customs regulations and procedure, of shipping and insurance documentation, and of principles and interpretation of maritime law. The advisability of uniformity of nomenclature for classification of merchandise will also be considered.

MEN YOU SHOULD KNOW ABOUT

F. A. Almstead, of Baker, Ore., is in New York.

W. H. Staver is making a professional visit to Denver.

L. A. Lavensaler, of Seattle, was recently in San Francisco.

Paul C. Schraps sailed for Ecuador from San Francisco on March 5.

K. C. Li, mining engineer of New York, is in the Philippine Islands.

Claud Hafer, of Southern Pines, N. C., has gone to Nevada on professional business.

C. W. Purington has returned to Tokio, Japan, after a short visit to the United States.

Frank M. Smith, smelter director of the Bunker Hill & Sullivan M. & C. Co., is in New York.

E. P. Mathewson will be the class day speaker at the Michigan College of Mines on April 19.

John D. Ryan, of New York, chairman of the board of directors of the Anaconda company, was a recent visitor in Houghton, Mich.

Frederick Laist, general manager of reduction works for the Anaconda Copper Mining Co., has returned to Butte from New York.

M. O. Tillard, underground manager of the Modderfontein, has been appointed manager of the Village Deep mine on the Rand.

Glenville A. Collins of Vancouver, B. C., and **William L. Dennen**, of Gloucester, Mass., were visitors in New York City last week.

W. H. Schacht, general manager of the Copper Range Consolidated mines, has returned to Painesdale, Mich., from a visit to New York.

T. R. Hunt recently returned to Denver from Neihart, Mont., where he has been constructing a 500-ton flotation mill at the Silver Dyke mine.

Dean S. H. Worrell, of the Texas State School of Mines, who is at present in Los Angeles, will return soon to El Paso. He is on six months' leave of absence.

Amor F. Keene, consulting engineer of New York, is on the Comstock on business pertaining to the Comstock Merger operations on the Middle Mines group.

Thomas L. Chapman has resigned as field engineer of the St. Joseph Lead Co., to take charge of the Estelle mine which adjoins the Cerro Gordo mine, at Keeler, Calif.

James MacNaughton, general manager of Calumet & Hecla and subsidiary properties, has returned to Calumet from a sojourn in the South. He is much improved in health.

W. E. Dunkle, mining engineer for the Guggenheims, recently arrived at Anchorage, Alaska, to direct development operations for his company in the Willow Creek and Kantishna districts.

Rowland King, managing director and secretary of the Mohican Copper Co. and the Alamo Gold Mining Co., who has spent the last winter in New York, is returning to Los Angeles.

H. W. MacFarren, a mining engineer on the staff of the Commissioner of the General Land Office, is studying conflicts in titles in the Red River petroleum area and will report to the Secretary of the Interior.

Frank W. DeWolf announces his resignation from the State Geological Survey of Illinois to become chief geologist of the Humphreys-Fohs oil interests with headquarters at the Great Southern Life Bldg., Dallas, Tex.

James S. Colbath, who has been engaged in installing a new cyanide plant for the Benguet Consolidated Mining Co., at Benguet, P. I., expects to have the plant in operation this month, and will return to his headquarters in El Paso, Tex.

Continued growth of the U. S. Bureau of Mines, especially in the supervision of leasing operations on public lands, has resulted in the creation of a leasing branch within the Bureau, the appointment of another assistant director, and several changes of personnel within the organization. **A. W. Ambrose**, assistant director, who is specially qualified in petroleum matters, has been placed in charge of the newly created leasing branch. He also will act as a consulting engineer to all branches of the bureau on matters relating to petroleum and natural gas. **D. A. Lyon**, chief metallurgist and supervisor of stations, has been appointed assistant director in charge of the research branch, which includes the functions and scope of the former investigations branch after the elimination of leasing matters. For the present, no appointment will be made to the position of supervisor of stations and Mr. Lyon will perform the duties of supervisor in addition to those of head of the research branch. **T. T. Read**, having asked to be relieved from his position as chief of the information service and assigned to investigative work, has been appointed a supervising mining engineer. During the absence of **F. J. Bailey**, assistant to the director, on a visit to the mine safety cars and stations, Mr. Read will serve as the acting head of the operations branch of the bureau and will later be assigned to appropriate field duties. **C. E. Julihn** has been recalled from service as chief mining engineer of the War Minerals Relief Commission and made chief of the information service. **Francis Winslow**, now connected with the division of war minerals supply, has been assigned to serve with the War Minerals Relief Commission as its chief engineer. **J. W. Furness**, who has been working with the war minerals supply division of the Bureau of Mines, has been given a permanent appointment in that division. All of these changes and appointments were effective on March 1.

THE MINING NEWS

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Leading Events

WAGES are advanced by the copper-mining companies in Michigan and in Montana, a logical consequence of shortage of underground labor.

The Guggenheim interests have bonded the Copper Mountain property, in the Kantishna district, Alaska.

The United Comstock Mines Co. has altered its method of mining at Virginia City. Mill still much below capacity.

Granby Copper and Consolidated Mining and Smelting companies have arranged working agreement for their operations in British Columbia. Government asked to provide import duty on metals.

The construction of a new zinc smelter at Tampico, Mexico, is said to be assured.

Figures show substantial increase in Canadian mining. Gold and silver output has increased greatly. Asbestos decreased in value.

Tin prices and tin-share prices climb together in London.

Arkansas has authorized a tax of 25c. per ton on bauxite produced within the state. The tax seems discriminatory.

Completion of Magma smelter in Arizona is now scheduled for Jan. 1, 1924.

Wages Increased in Michigan and at Butte

20 Per Cent Raise in Michigan; 50c. in Butte—Consequence of 17c. Copper and Shortage of Miners—Further Advances Intimated

A WAGE INCREASE of approximately 20 per cent for all classes of labor has been put into effect as of March 1 by the producing companies of the Michigan copper district. Wage rates vary little at the several mines. Where company account predominates, a higher day's pay rate will be paid to strike a closer average with mines in which the contract system prevails. Miners, company account, will receive from $4.15 to $4.25 per day; miners, contract, $4.50; and underground "laborers," $3.75 to $3.80.

Virtual promises of further increases if improvement in the metal market continues are made in statements issued in connection with the present advance. The statement of Calumet & Hecla and subsidiary companies says, in part:

"It will always be the policy of this management to make such increases from time to time as future conditions in the industry may warrant."

In similar vein, Copper Range Consolidated informs its employees that "all indications at present point to further improvement in the metal market which, in turn, should mean greater prosperity to the employees of this company."

Although the present increase is not expected to attract many men to the district, it is hoped it will influence those now employed to remain, particularly in view of the expected further improvement in the price of the metal.

In connection with the wage advance, it is pointed out that the mines are not yet fully realizing on 17c. copper, the greater quantity of metal now being delivered having been contracted for at 14c. sixty to ninety days ago. Two or three months may elapse before the mines reap the advantage of the improved price. Not all of the mines operated at a profit at the lower market figure, and the wage advance is approximately half of the price increase.

On March 7 the mining companies at Butte posted notices to the effect that commencing on the day shift on March 15 the wages of all days-pay employees would be increased by 50c. per day. The companies include the Anaconda Copper Mining Co., the Butte & Superior Mining Co., the North Butte Mining Co., the East Butte Mining Co., the Davis-Daly Copper Co., and the Clark companies operating the Elm Orlu mine and the Timber Butte mill. The Anaconda company also increased wages of all its employees at Anaconda and Great Falls.

An increase of 50c. was made voluntarily by the same companies in September, 1922, so that a total of $1 has been added to wages within six months. It has been impossible to operate the mines on the scale desired because of the shortage of miners and this action, it is hoped, will attract more men. Approximately 13,000 employees will be affected in the three districts mentioned. The following table shows the scale in effect after March 15 although a great many of the miners work on a contract basis and earn considerably more than the regular wage.

Wage Scale at Butte in Effect March 15, 1922

Blacksmiths	$6.00
Blacksmith helpers	5.25
Blacksmith, boss	6.50
Carpenters	6.00
Carpenters, boss	6.50
Compressor men	6.00
Engineers (first motion hoists)	6.50
Engineers (geared hoists)	6.00
Electricians	6.00
Electrician helpers	5.25
Electrician, boss	6.50
Laborers	4.75
Laborer, boss	5.25
Miner (all underground men engaged in mining)	5.25
Miners (in shafts, station cutting and winzes)	5.75
Pumpmen	6.00
Pipefitters	6.00
Pipefitter helpers	5.25
Pipefitter, boss	6.50
Station tenders	5.75
Watchmen	4.50
Shift bosses	6.75

United Comstock Changes Mining Method—Output Still Low

Mine and mill operation of the United Comstock Mines Co. at Virginia City, Nev., are satisfactory, although the tonnage milled is said to average less than 1,500 tons per day. Mining methods have been changed and the system of finger raises and shrinkage stopes, which has been successfully used in the Ruth mine of the Nevada Consolidated at Ely, is being adopted. The new seven-ton balanced, skip ore pass from the upper levels to the main haulage tunnel has been completed and is in operation. A few necessary alterations and additions to the milling plant have been completed and it is confidently expected to be able to increase the tonnage.

Guggenheims Bond Copper Mountain Holdings in Alaska

Property in Kantishna District—Lead and Zinc Developed—50-Mile Railroad Necessary for Exploitation

By E. N. Patty

An important mining transaction, just consummated, is the bonding of the Copper Mountain property in the Kantishna district, adjacent to Mt. McKinley National Park, Alaska, by the Guggenheim interests for a reported figure of $1,000,000. This is a large contact-metamorphic deposit of galena and zinc blende and the portion so far explored carries 20 to 30 per cent of both lead and zinc with minor values in silver.

It is a new find and if it stands up under exploration work will add another big mine to Alaska. The Kantishna district received no attention, except from placer operators, until the Government Railway from Seward to Fairbanks placed the district within 50 to 75 miles of railway transportation.

The history of the property is short but is a significant answer to those who believe that all the worth-while mines have been discovered. The holdings were staked about a year ago by two prospectors, Grant and Jiles, but not before other prospectors had passed over it and even camped near the outcrops without appreciating their value. Tom Aitken, a well-known Alaskan operator, and his partner John Price secured a lease and bond from the locators and last summer spent $10,000 prospecting the outcrops. These results have been encouraging but the property is not yet proven. Next summer the Guggenheims will carry forward new development work, probably with diamond drills.

The property is 60 miles from the Government Railway but over a country favorable to road building. The Alaskan Road Commission is building a wagon road into the district. The deposit will have to show orebodies that will warrant the building of at least 50 miles of a branch railway before it can be classed as a real mine.

If such a branch railway were built it would give life to a number of promising lead-silver veins in the same district. This would be the only large lode mine operating north of the Alaskan Range. These possibilities have served to energize prospectors.

Arizona Mining Companies Oppose S.P.-R.I. Railroad Merger

That the copper producers of Arizona are not in sympathy with the proposed merger of western railroads, hearings on which are now being conducted by the interstate commerce commission in Washington, was evidenced by the receipt of a formal protest prepared by the Arizona chapter of the American Mining Congress. The statement to the commission declared that the contemplated consolidation of the Southern Pacific and the Rock Island would tend to reduce competition and hold the freight rates at a higher level.

New Zinc Smelter at Tampico Mexico, Says Report

The International Ore and Smelting Co. of Monterey and Saltillo has notified the government authorities of its plans to construct a zinc smelting plant at Dona Cecilia, a suburb of Tampico. This company does a large export business of zinc ore from its mines in the states of Tamaulipas and Nuevo Leon.

Value of Canada's Mineral Output Increased $11,106,000 in 1923

Gold Production Feature; Up 31 per Cent—Silver and Lead Good—Cobalt Valued at $1,442,000

Canada's mineral production in 1922 was valued at $183,000,000, an increase of $11,106,000 over the value recorded in the preceding year according to a report issued on March 7 by the Dominion Bureau of Statistics.

The year's output was made up of: metallics, $61,000,000; non-metallics, $82,500,000; structural materials and clay products, $39,300,000.

The outstanding feature of the metal production was the excellent gain made in the output of gold by the two important producing provinces, Ontario and British Columbia. The total gold production for Canada during the year amounted to more than 1,230,985 oz. and compared with the 1921 output showed an increase of 31.0 per cent. The increased prices and the lively markets for silver and lead were reflected in excellent gains.

Silver advanced 30 per cent in quantity and 40 per cent in value while lead showed an even wider spread between quantity and value percentages, production rising 41.2 per cent and the value increasing more than 77.3 per cent over the record of the previous year.

Nickel and copper were lower than in 1921, although the advance in the price of copper checked the decline in value to 2.6 per cent as compared with a 9 per cent decrease in quantity.

The increase in the output of zinc was further emphasized by the rise in price of this metal to an average of 5.716c. per pound for the year, as compared with 4.655c. in 1921, both quotations from the St. Louis market. The 6 per cent increase in quantity resulted in a 30 per cent advance in the total value reported. The year-end saw a marked revival in the production of cobalt and more than 443,000 lb. valued at $1,442,000 was produced. Compared with 1921 data, these figures showed 76 per cent greater quantity and nearly 91 per cent increase in value.

Metals as a whole advanced 23.9 per cent to a total value of $61,144,990 as compared with $49,343,232 in 1921.

The output of asbestos in 1922 reached a total of approximately 136,657 tons of all grades, valued at $4,664,106 as compared with 92,761 tons valued at $4,906,230 in 1921. The appreciable percentage increase in production was due almost entirely to the activity about the mines during the closing months of the year.

Gold Mining Companies at Alma, Colo., Look for Active Summer

Both Lode and Placer Operations Expand—New Mill and Dredges May Be Built

By James E. Dollison

Mining conditions in the Alma district are improving, and the outlook for the coming summer is good. Several companies have employed small forces on development work throughout the winter, and others are making preparations to start operations as soon as the weather conditions permit.

The London Gold Mines Co. has the breast of its new lower tunnel beneath the South London workings and is preparing to drive a 600-ft. raise to make connections.

The London Mines Leasing Co., lessee of the North and South London workings, has a large force of men employed retimbering and opening up the mill ore left in these workings. They have developed to date about 50,000 tons of mill ore showing a minimum value of $20 per ton. A mill will be erected the coming summer for the treatment of this ore.

Lessees on Block No. 14 South London have about 200 tons of high-grade gold ore ready to ship to the A. V. smelter, at Leadville, as soon as roads can be opened.

A nice streak of high-grade gold ore has been opened by lessees on the Butte property, and 100 tons has been mined and is ready for shipment.

The Platte River Dredging Co., operating on the Platte River near Fairplay, Colo., has operated its boat all winter with satisfactory results. It is reported that it contemplates the erection of a large all-steel dredge.

E. W. Shrock has secured a large acreage adjoining the holdings of the Platte River Dredging Co. on the south, and has had a prospect drill in operation for several months testing the ground. If these tests prove satisfactory he will erect a large dredge for the recovery of the gold.

The Tonopah Placers Co. has had a prospect drill in operation on its holdings along Four Mile Creek, testing the gravels to determine if they contain sufficient gold value to warrant the erection of a dredge.

Navy Will Sell 1,930,000 Lb. of Zinc

The Navy Department is offering for sale 1,930,000 lb. of surplus zinc plate. Those desiring to make purchases of this material are required to submit sealed bids to the Washington Navy Yard prior to March 19. The material offered for sale is held at various points as follows: At Squantum, Mass., 100,000 lb. boiler sheet zinc; New York Navy Yard, 50,000 lb. boiler standard; Hampton Roads, Va., 750,000 lb. boiler standard; Norfolk Navy Yard, 872,000 lb. boiler standard; Philadelphia Navy Yard, 150,000 lb. boiler standard; Portsmouth Navy Yard, 11,500 lb. boiler standard.

Granby Copper and Consolidated Mining & Smelting Companies Will Co-operate

Working Arrangement Points to Economical Production in British Columbia—Seek Tariff on Metals

BY F. H. MASON

THE Granby Consolidated Mining Smelting & Power Co., has made arrangements with the Consolidated Mining & Smelting Co. of Canada for the treatment at Trail of concentrate from the Copper Mountain mine, which undoubtedly will be acquired by the Granby company. This was anticipated by those who have been following closely the trend of events. The power to run the Canada Copper mine and mill is supplied by the West Kootenay Power & Light Co., which is a subsidiary of Consolidated and the mine and mill are served by the Kettle Valley Railway Co., which is a subsidiary of the Canadian Pacific Railway Co., as also, to all intents and purposes, is the Consolidated company. Thus a friendly agreement between Granby and Consolidated seemed inevitable if the best interest of the Canada Copper property was considered.

This arrangement with the Granby company has put an entirely new phase on the Trail outlook, so far as copper is concerned. The Rossland ores are essentially gold ores, the copper content sometimes being insufficient to form a concentrating medium for the precious metals. The amount of copper derived from the ore is comparatively small, and quite inadequate to keep the copper refinery in operation at anything like its capacity of 50 tons of refined metal per day. It is true that Consolidated owns the Old Sport mine and has a controlling interest in the Sunloch mine, both of which are on Vancouver Island, and a considerable reserve of copper ore has been proven at each property, but neither property is equipped with the necessary plant for producing concentrate and shipping on a large scale. The logical smelting center for Vancourver Island concentrate is somewhere on the coast, and now that Granby and Consolidated have come to a friendly understanding it is likely that, when plants are erected, the concentrate will be shipped to Anyox. The Copper Mountain mine, which is equipped to produce 2,000,000 lb. of copper in the form of concentrate monthly, can make up the deficiency at Trail, and this will place Consolidated in a better position to press the Dominion Government for an import duty on pig copper and on copper rods and bars; Granby, too, probably will use its influence in this matter.

The officials of the Consolidated Mining & Smelting Co., backed by the Associated Boards of Trade of Eastern British Columbia, are making a strong effort to induce the Dominion Government to impose import duties on scrap brass, copper and zinc, and on all base metals entering Canada up to the amount that Canadian producers are able to supply. They likewise want the government to probe the price of coal and coke.

J. J. Warren, president of the company, recently stated that the copper department of the smelter and the company's mines at Rossland had been closed only because of the difficulty of obtaining coke at a reasonable price. When the plant was closed coke was costing the company $14 per ton at Trail, and at that figure it was quite impossible to operate the Rossland mines on a crude-ore basis. He also stated that the Sullivan concentrator would be finished in the summer and then the Trail concentrator would be available for Rossland ore.

Granby is operating its own coal mine and coke ovens, and the ovens are capable of producing more coke than is needed at the Anyox smelter. In 1921 they were operated at only 43 per cent capacity, and last year probably at less than that, consequently Granby should be able to supply Consolidated with coke at a markedly cheaper rate than that at which it can be obtained at Fernie. Apparently the arrangement that has been made between the two companies should make for efficiency in the production of copper by both.

Arkansas Taxes Bauxite 25c. Per Ton Produced

What is alleged to be a discriminatory tax on bauxite has been provided for by a law recently passed by the Legislature of Arkansas.

The law in question imposes a severance tax on output of timber, minerals, and other raw materials of from 2 to 3 per cent of the market value of the products at point of severance. Bauxite is, however, singled out for a flat production tax of 25c. a ton, which amounts to a tax of 25 per cent based on the average price of bauxite ($10) during 1921 and 1922, or 3.9 per cent based on the average selling price of domestic bauxite produced ($6.38 a ton) in 1921, and 5.2 per cent based on the average selling price of domestic bauxite produced ($4.80) before the war. As a contrast, the new bill taxes coal one cent per ton and timber 7c. per thousand.

The bill was aimed at the Aluminum Company of America which virtually monopolizes the aluminum industry of the country although several other companies have produced and marketed some bauxite. Adding 25c. per ton to the cost of domestic bauxite—Arkansas produces approximately 90 per cent of the domestic supply—may result in the curtailing an enterprise that adds much to the general wealth of the state. Considerable foreign bauxite seeks a market in America that influences the market for this low-priced raw material.

Comstock Merger Development Encouraging

Development work is being pushed in the Middlemines group, on the Comstock Lode and owned by Comstock Merger Mines Co., and over 200 men are employed. Most of the work is done from the Hale and Norcross tunnel, although by arrangement with the Comstock Leasing Co., whose ground is included in the Comstock Merger deal, the company is able to prospect and sample on several intermediate levels from winzes to a maximum depth of 400 ft. below the Hale and Norcross tunnel, which means nearly 700 ft. below the outcrop. Results are said to be satisfactory so far, and large ore reserves are being blocked out, partly as old fills and partly as rock in place. In one place the ore has been proven to have a width of 200 ft.

Jardine Mining Co. Installs Equipment for Recovering Arsenic

The Jardine Mining Co., operating six miles northeast of the Gardiner entrance to Yellowstone Park, is erecting a reverberatory furnace with arsenic kitchens, for the purpose of roasting its concentrates and extracting arsenic. This plant will be completed and in operation by March 20, and will turn out approximately 100 tons of white arsenic a month, on the present scale of mining and milling. The arsenical ores at Jardine appear to be free of antimony, bismuth or any other element which would interfere with the production of a high quality of arenious oxide. The arsenic which will be shipped from the Jardine plant will not be an addition to the country's supply as shown last year, as prior to January 1, 1923, the concentrates from this property, in the same volume as they are now produced, were being sent to the A. S. & R. smelter at Tacoma, Washington.

The district about Jardine has, for over fifty years, been the scene of more or less gold mining, which has been greatly hampered by the arsenical character of the pyrites in which most of the gold is found.

Should the market warrant the investment, a large development of arsenopyrite could undoubtedly be made on the Jardine property.

Rhodesian Mineral Output

The British South Africa Co. announces through Reuters the following production figures from Southern Rhodesia during January, 1923. Comparative figures are given for the preceding month and also for the corresponding month last year.

	January 1923	December 1922	January 1922
Gold, oz.	56,630	55,737	53,541
Silver, oz.	14,731	15,034	13,696
Chrome ore, tons	14,750	12,307	1,464
Copper, tons	278	284	286
Asbestos, tons	1,708	1,858	558
Arsenic, tons	63	49	41
Mica, tons	12	8	4
Diamonds, carats	26	38	12

The number of producers is 205 and the value of the gold produced £261,310.

Americans Develop Metal Mines After Mexicans Find Them

During 1922 Titles Were Issued to 1,728 Mines—300,000 Employed in Mining Operation in Southern Republic

It is declared in a statement just issued by the mining bureau of the Department of Industry and Commerce of the Mexican Government that though a great majority of mining claims in this country are originally located by native Mexicans the properties soon pass into the hands of foreigners, especially Americans. This is usually true of mine prospects which give indications of unusual richness of ore. It is pointed out that practically all of the famous mines of Mexico were once owned by Mexicans, but were permitted by them to pass into foreign ownership.

In many cases, the statement asserts, rich outcroppings of ore were found by goat herders, who, being without money with which to develop the properties, sold them to Americans for a mere song. Rich, undeveloped claims which were discovered by poor Mexicans are so numerous that it is regarded by Americans and other foreign prospectors as not worth their while to do any prospecting on their own account. They find it cheaper to buy the claims of the natives.

The statement of the mining bureau says that during the year 1922 a total of 1,728 titles to mines were issued. Of this number 1,376 were patented by Mexicans; 175 by Americans; 49 by Britishers, and the others to various other foreigners. The government statistics show that more than 50 per cent of the mines which are now being worked in Mexico are owned by Americans and that their development was brought about by American capital. The Mexicans do the pioneer work in the industry, but rarely derive much profit from their discoveries. It is estimated that the mines of Mexico give employment to more than 300,000 laborers.

Many Names in List of Shippers to Trail Smelter

Following is a statement of ore received by the Consolidated Mining and Smelting Co. at its Trail smelter during the period Feb. 22 to 28, 1923, inclusive:

Name of Mine	Locality	Tons
Bunker Hill	Kellogg, Idaho	40
Henderson group	Smithers, B. C.	25
Knob Hill	Republic, Wash.	309
Lone Pine Surprise-Last Chance	Republic, Wash.	265
L. T.	Slocan, B. C.	4
Molly Hughes	New Denver, B. C.	29
Monitor	Three Forks, B. C.	23
Meteor	Slocan City, B. C.	8
Paradise	Lake Windermere, B. C.	133
Quilp	Republic, Wash.	54
Silversmith (zinc)	Sandon, B. C.	175
Silversmith (lead)	Sandon, B. C.	44
Steel group	Lake Windermere, B. C.	33
Surprise	Republic, Wash.	156
Tariff	Ainsworth, B. C.	9
Victor	Three Forks, B. C.	31
White Water	Retallack, B. C.	33
Company mines	.....	10,860
	Total	12,231

Silversmith Improves Plant at British Columbian Mine

Nets $25,000 Per Month—New Mill Equipment and Modern Change House

The estimated net smelter returns from the Silversmith mine at Sandon, B. C., in December were $51,170, the expenses $26,344, including mining milling, royalty, and taxes. The crude and concentrated silver-lead ore shipments were 453 tons and the zinc concentrates 263 tons. In January the net smelter returns were $53,315 and the expense $28,629, the lead shipments were 488 tons and zinc 263 tons. The zinc concentrates contain 50 per cent zinc and 35 oz. of silver to the ton and the lead concentrates 60 per cent lead and 100 oz. of silver.

For the first time in its history the mine and mill were operated throughout the winter. This was due to the use of a 200-hp. semi-Diesel engine, which provided the additional power required when the water flow was reduced by low temperatures. Operations were continuous, even at 28 deg. below zero.

The resources of the mine have been increased greatly by the completion of a raise from the 500 to the 400. Ore for milling and shipping is being taken from the 500, 800, 900 and 1,100 levels, where the appearance of the stopes is good. The 1,000 level is being run east for an orebody that crops near Sandon Creek.

A new zinc section in the mill is nearly completed. It includes additional settling tanks, an American filter and storage capacity for 2 000 tons of zinc concentrates. A modern machine and blacksmith shop has been installed at the mill and a new oil forge at the mine blacksmith shop. The oil forge will increase the quantity of steel that can be sharpened each day and leave time for the repair of mine cars. A new boarding house and a change house have been completed and are in use. The change house is equipped with shower baths and other modern accessories. The number of employees is 110.

Zinc Concentrator Closed Down at Broken Hill

By Cable from Reuters to "Engineering and Mining Journal-Press"

Broken Hill, N. S. W., March 9.—One of the Zinc Corporations concentrators has been closed down.

News from Washington

By PAUL WOOTON
Special Correspondent

Preliminary Work for Senate Gold-Silver Inquiry Under Way

Data Being Compiled—Bureau of Mines Offers Assistance—Wide Scope of Inquiry

The illness of Senator Nicholson, of Colorado, and the enforced absence from Washington for a month of Senator Oddie and Senator Pittman, have made it necessary to delay the organization of the Commission on Gold and Silver Inquiry. It is the intention, however, to make Senator Nicholson its chairman.

This time will not be lost, however, as literature on the subject is being assembled and abstracted. Abstracts also are being made of the experiences of commissions and committees which have investigated monetary or precious-metal questions. An analysis also is being made of freight rates on gold and silver ore as compared with the rates on other commodities. Other basic information is being gathered, so that the commission when it meets in April will have before it in concise form the results of similar inquiries and certain other data which will make possible a more intelligent determination of the scope of this investigation.

The opposition to the inquiry emphasized to such an extent the point that the Bureau of Mines is better equipped than are members of Congress to undertake work of this character that it gave rise to an impression that such a thought might have been inspired in that Bureau. H. Foster Bain, the director of the Bureau, states emphatically that no such thought ever has been entertained. Though he believes his Bureau will be able to contribute importantly to the success of the inquiry, he is convinced that much more effective results can be obtained by a commission of Senators than by a committee of Bureau specialists. The field of the inquiry covers much more than the engineering and technological phases of the subject and must enter the realm of politics and international relationships into which Bureau of Mines engineers could hardly venture with propriety. Mr. Bain is in complete sympathy with the investigation and believes the opportunities of getting profitable results have been enhanced materially by the fact that it is to be undertaken by legislators who have had first-hand contact not only with mining matters but with monetary questions as well.

War Minerals Awards

W. K. M. Gilkey, of Marion, N. C., should be awarded $640.17 for losses sustained in connection with his war minerals operations, according to the War Minerals Relief Commissioner. An award of $488 in favor of G. T. Pinson, of Prairie City, Ore., also has been recommended. A disallowance has been recommended in the claim of John C. Evans, of Sacramento, Calif., on the ground that no net loss has been established.

Iron-Ore Treatment Will Be Studied by Bureau of Mines

Additional attention is to be given the beneficiation of iron ore at the Tuscaloosa experiment station of the Bureau of Mines during the next fiscal year. Plans now are being made which will permit of active work on that subject after July 1. The work will be under the immediate supervision of Oscar W. Lee and will follow plans worked out by Dorsey Lyon, the assistant director of the Bureau in charge of research, and E. W. Davis, one of the Bureau's consulting engineers. In connection with the Bureau's work on iron ore, another test run is to be made in May in the experimental blast furnace at the Minneapolis station.

Safety Station Planned for Coeur d'Alene in Idaho

The Bureau of Mines is establishing a new safety station at Wallace, Idaho. There has been a series of underground fires in the Coeur d'Alenes which has pointed out the advisability of maintaining a safety station in that district along the lines of the one at Globe. K. T. Sparks, of the Butte station, has been detached to take charge of the work at Wallace. The details under which the new station will be operated will be arranged by F. J. Bailey and D. J. Parker next month. It is probable that one of the old mine rescue cars will be sent to Wallace to use as the station office.

Fireproofing of Mine Timbers Discussed at Conference

Plans for systematic research in the matter of fireproofing mine timbers were discussed last week in Washington at a conference attended by the chief mining engineer of the Bureau of Mines; W. J. Loring, former president of the American Mining Congress, and a representative of the Madison laboratory of the Forest Service. It is hoped that some material may be found which can be used as a coating for mine timbers which will at once preserve them from decay and make them slow burning even if it is impossible to devise a substance which would render them entirely fireproof.

Government Officials See Little Relief for Labor Shortage

Though the immigration figures show that the United States is absorbing an unusual number of skilled laborers from the north European countries, apparently no great number of metal miners are included in this influx. Such government studies as it has been possible to make of the labor situation in metal mines indicate that the industry is facing even a greater shortage of labor than at present. There is practically no opportunity of securing more skilled men by increasing the wage level. Resort must be had, it is believed, to underground loading equipment and other devices to supplant labor.

News by Mining Districts

By Special Correspondents in the Field

London Letter

Falcon Mines Has Paid Small Dividends —Tin Prices and Tin-Share Prices Soar

BY W. A. DOMAN

London, March 2—Although at the Falcon Mines (Rhodesia) to the end of June 1922 no less than 1,416,673 tons of ore had been treated for a yield of 24,913 tons of copper, 277,435 oz. of gold and 532,365 oz. of silver, of a value of £3,546,476, shareholders have only received a return of £80,000 upon their capital of £400,000. This is due to the fact that the productive period started with an insufficiency of working capital, and leeway has never been made up. The directors have had to borrow from other than shareholders—an expensive procedure—and still have approximately £60,000 to repay. For some time the price of copper has been against the company. C. E. Parsons, the consulting engineer, has done remarkably well in reducing costs. In the twelve months to June, 1921, they were 43s. 5d. per ton; last year a cut of 5s. 1d. was effected. In the six months to December last they ruled at slightly over 38s. Per ton of blister copper the cost was £111 as shown in the current report. Crushing averaged 15,846 tons monthly; the minimum to make ends meet and show profits at existing prices, is 15,000 tons monthly. Development has fallen behind owing to lack of funds, with the result that ore reserves have shrunk by 150,000 tons to 419,600 tons, sufficient for 2½ years, all except about 60,000 tons being broken ore. The average is 4.7 dwt. of gold and 1.92 per cent copper worth 38s. a ton. The year's output from 190,155 tons of ore was 3,262 tons of copper, 36,690 oz. of gold and 70,458 oz. of silver, valued at £323,387.

Prices of metals being on the up grade, base metal shares are coming into favor. Particularly is this the case with copper and tin. As regards the former, Paris is buying heavily and Rio Tintos since the beginning of February has risen from £31⅞ to £39¼. According to some authorities, tin is expected to reach £250 per ton within a reasonable period. This explains the reconstruction schemes that are being brought forward in order, it is said, to increase production to meet heavy American demands. As some of the Nigerian companies claim to have lowered their expenses to £80 per ton of concentrates, their prospects have certainly improved and speculators are going in for "long shots." Even Cornish companies are beginning to take on a more encouraging aspect, Geevor, in particular being revitalized.

Killifreth, a Cornish mine, is raising £30,000 of additional capital in participating priority shares, one of the main objects being to open up the Wheal Busy section. This mine contains a good deal of arsenic now selling at £75 a ton and said to be in great demand for the United States. In connection with the revival of tin mining and the advance in the price, an authority yesterday expressed the view that the present figure of £211 12s. 6d. per ton is fictitious, that there is too much gambling in the metal and that the share market is made to correspond.

Proposals are on foot for amalgamating the Langlaagte Estate and the Consolidated Langlaagte Mines (Rand), on the basis of two shares of the former for three of the latter, and the Langlaagte Estate capital will be raised from £950,000 to £1,519,833. The Langlaagte Estate has only a short life in prospect.

Montreal Letter

Hollinger Power Development Again "Assured"—Brigham Makes Optimistic Forecast

BY ALEXANDER GRAY

Montreal, March 10—This time Hollinger Consolidated Gold Mines of Ontario has it in writing. The Provincial Government promises to provide either one of two water powers on the Abitibi River, for the Hollinger purposes. Heretofore, it appears, official proposals were in unsatisfactory form. Now, it seems, the controversy is nearing an end and that Hollinger will be enabled to proceed with its plans not only for power but for the enlargement of the milling plant. General Manager Brigham is ready to place his orders. He says, were it not for the delays, instead of 2,000, he would be crushing over 6,000 tons a day. His ultimate objective is 7,000 or 8,000 tons. When he gets there he figures his grade will be about $7.75 and his total cost per ton milled, $3.75. Hollinger lower workings have disclosed orebodies of large width. Some high-grade sections have been opened up during the past year. To use the figurative comment of an official: "There are stopes as wide as a boulevard." Moreover, on one level an orebody is being developed in the Schumacher ground — recently purchased. It was a piece of good fortune to begin with, to pick up this vein and to be able to follow it, thus far, in Schumacher territory for a distance of approximately 50 ft. The intention is to leave alone the upper area of the Schumacher. As the "drag" of certain of the Hollinger veins at the lower levels is toward the Schumacher, Mr. Brigham, without even confiding that he had an orebody already, remarked to shareholders in annual meeting that "five years from now I think it will be shown we made no mistake when we bought the Schumacher." Meanwhile higher grade ore is being developed in the Hollinger upper levels; this justified Mr. Brigham in intimating that with the enlarged mill he can maintain a grade of $7.75.

La Rose company, of Cobalt, after many trials and tribulations with prospects elsewhere in northern Ontario, has reverted to the Porcupine area. It made a profit out of its Cobalt operations last year but it was so small and shareholders are so importunate, the management felt obliged to go further afield. So an option has been taken on the Moyer and Bremner properties situated on the south of Porcupine Lake. It was near there that Dr. Hunter did the first work at Porcupine. The locality until now has not been seriously considered. Owing to Dome and Dome Extension development, however, and noting that a porphyry contact is present, along with other geological features, it is proposed to drill the Moyer and Bremner ground. As yet Whitney Township has not come up to expectations. Perhaps La Rose will fare better than others. New England and New York shareholders hope so.

Johannesburg Letter

Prohibition of Use of Old-Type Drills Considered—Diamond Market Strengthens

BY JOHN WATSON

Johannesburg, Feb. 6—The following crushing results for the month of January have just been published:

Ore Crushed,	Tons	Estimated Value £	Working Costs per Ton Milled s.	d.	Estimated Profit £
Brakpan	64,600	108,193	20	11.8	42,624
City Deep	92,500	171,070	23	11.2	60,362
Cons. Main Reef	55,000	86,291	25	1.5	17,195
Crown Mines	219,000	293,845	20	0.4	74,483
Durban Rood. Deep	33,800	49,403	25	2.4	6,812
East Rand P. M.	130,500	145,145	22	2.5	242
Ferreira Deep	34,000	40,140	20	7.7	5,042
Guldenhuis Deep	54,100	59,722	21	10.4	562
Knight Central	34,000	30,336	15	3.8	4,296
Modder B	63,000	148,205	21	7.9	79,973
Modder East	27,500	55,423	25	7.4	20,197
New Modder	114,000	226,391	16	3.7	133,429
Nourse Mines	46,000	60,451	24	9.4	3,443
Robinson G. M.	15,000	18,177	18	1.2	4,600
Rose Deep	54,800	53,534	17	2.7	6,338
Springs	54,000	102,445	21	11.3	45,309
Wolhuter G. M.	34,500	35,243	18	8.9	2,908
Village Deep	60,000	82,836	22	3.2	16,038

A heavy fall of rock occurred, at the Simmer and Jack gold mine, on Jan. 31, due to a "pressure-burst." Half the stope, between the 30th and 31st levels, fell in. Six natives were entombed. As the hanging rock continued to fall, rescue work was dangerous. Three of the natives were released and subsequently died. One white miner was caught by a slab of stone, but not seriously injured.

The Minister of Mines stated on Feb. 1 that arrangements had been concluded by the Government Mining Engineer with the Chamber of Mines for a discussion next week on the question of the possible prohibition of use of the older type of Leyner drill.

A telegram from Bulawayo reports renewed mining activity in the Tati district, Bechuanaland, where one of the Rand groups is stated to have acquired the Lady Mary and New Prospect Mines.

S. B. Joel, interviewed in London, recently said: "Since Jan. 1 sales of diamonds constitute a record for the last three years. The United States is purchasing on a large scale. The stability of the diamond market is strengthened by the control of the stones from Angola and the Congo."

On the Johannesburg Stock Exchange, buying and selling orders from London still governed the position, during the last week, but were on a smaller scale and local sellers were more in evidence. The British acceptance of the American terms for funding the war debt is likely to raise the value of sterling and reduce the price of gold; but it is regarded here, as a "bull" point, as settling an awkward situation between the two countries.

BRITISH COLUMBIA

British Columbians Resent London Silver Control

At a convention of the Associated Boards of Trade of Eastern British Columbia held recently at Nelson, B. C. the silver situation was prominently discussed in which it was claimed that the low price of silver in Canada and elsewhere outside of the United States was due to manipulation by world-financiers chief among whom being London interests. It is claimed the price of silver is fixed in England without regard to supply and demand and that London has used this arbitrary power for years. The report of the convention advocates the treatment of silver as a world commodity and urges co-operative effort to stabilize the price.

Nickel Plate Will Produce Again

The Hedley Gold Mining Co. will restart the mill at its Nickel Plate mine, at Hedley, early in March. The mill was closed in December, to allow the development work at the mine to get ahead, and about 40 men have been employed steadily since the mill was closed. The Nickel Plate has been one of the best gold producing mines in the Province, but during the war production was pushed and development neglected, and after the war industrial conditions were such that until now it has not been possible to build up a reasonable ore-reserve. As, besides gold, the mine produces a considerable quantity of arsenic, and, as arsenic is in great demand, the prospects of the mine are brighter than they have been for some time.

Indian Gold Production

By Cable from Reuters to "Engineering and Mining Journal-Press"

London, March 10.—The output of gold in India during February totaled 32,331 oz.

ONTARIO

Orr Property Will Be Developed

The Teck-Hughes is preparing to develop the Orr property, which it recently acquired, on three different levels. The Teck-Hughes shaft will be down to 1,100 ft. in April, which will be the deepest level in the Kirkland Lake district. During the last six months mill ore has averaged over $30 a ton so that substantial profits are being made. In January production amounted to $89,294, an average recovery of $28.78. Production in the first two weeks of February was $53,000.

Sutherland Seeks Control of La Rose

Another attempt is being made by N. H. Sutherland, of the firm of F. C. Sutherland & Co., mining brokers and promotors, to obtain control of the La Rose company, operating at Cobalt. A circular asking for proxies has been issued. Numerous charges against the directors were made, but they are not taken seriously by the public. It is anticipated that the present attempt will meet the fate of the one last year, when Mr. Sutherland was decisively defeated.

The company's annual report shows that notwithstanding the loss of the customs mill which treated the ore and the closing down of the mines for several months, there was produced a total of 469,000 oz., from which was realized a profit of $44,000. Net current assets as of Dec. 31 were $409,000. A dividend of 10 per cent has been declared payable March 24 to holders of record March 8.

MEXICO

H. Taylor Denounces Two Groups of Claims

Harvey Taylor, of Colonia Dublan, has located two groups of mines in the Escondido Mountains near Casas Grandes, in the northern part of Chihuahua. One of them, to be titled as the Rey de Plata, comprises twenty-one contiguous claims, which are traversed by a strong vein of silver-lead ore; the other will bear the nome of Rey de Plomo, and is composed of eight claims. The ore is principally lead. These new properties are near the Triple and Heather mines.

Alaska Juneau Netted $12,500 in February

Alaska Juneau's operating results for February, 1923, were excellent, an estimated total of $12,500 accruing to surplus account. A total of 213,400 tons was trammed, of which 119,300 tons was rejected as coarse tailing and 94,100 tons was milled. Total recovery was $143,000, or $1.52 per ton milled ($0.67 per ton trammed). Operating costs were $109,000 or $1.16 per ton milled ($0.51 per ton trammed); operating profit was $34,000. Expenditures at Juneau on capital account were $6,000; interest on indebtedness $13,000; taxes, insurance, legal and office expenses $2,500; total $21,500; estimated surplus for February $12,500.

ALASKA

Review of Winter Activities in Interior of the Territory

By E. N. Patty

There are only three or four small lode mines in operation this winter in Interior Alaska but a number of properties will resume before the ice goes out. On the whole there is a more optimistic tone in the Interior and 1923 will undoubtedly outrank the year just passed.

Many of the placer mines are active this winter. Several outfits are drift mining in the Fairbanks district and getting out dumps for summer sluicing. The Hammon dredge interests are expected to resume drilling to further test their project of installing dredges on creeks adjacent to Fairbanks.

The Tom Aitken dredge on Candle Creek near McGrath enjoyed its most successful season during 1922 and it is authoritatively reported that a profit exceeding $500,000 was made. The Inyoko Dredging Co. is moving its dredge from Forks to Gaines Creek and is building at Tacotna housing equipment and barns. The Treadwell company operated a 10-stamp mill last summer at its Nixon Fork mine on the Kuskokwim, but operations are closed down for the winter. This property is not proving up as well as the early results indicated. It is reported that a dredge will be built next summer on Gaines Creek. Options on the claims have been taken by Thomas M. Reed and associates.

In the Iditarod country two dredges operated profitably and when they closed down for the season, over $1,000,000 in gold was transported by dog teams to Anchorage. The season's clean-up on Cache Creek of the same district is estimated at $250,000.

In the Koyukuk country several small operators are working this winter, particularly on Nolan Creek. There was a shortage of supplies during the early part of the winter season because small trading steamers bringing provisions up to Koyukuk were frozen in before they reached Beetles.

The large steel railway bridge across the Nenana River at Nenana has just been completed for the Railway Commission and the narrow gauge line between Nenana and Fairbanks is now being changed to standard gauge. This will eliminate the transfer at Nenana and next summer standard gauge trains will operate the entire distance of 480 miles between Seward and Fairbanks. The Government Railway is being operated with splendid efficiency and is proving that its construction was one of the most helpful things that ever happened to Alaska.

High fuel costs have held back many mines of the interior. The Healy River Coal Corporation is installing a modern plant in the Nenana coal fields and producing about 150 tons per day of subbituminous coal. Next summer miners in the Fairbanks district can buy this coal delivered to the district for $4 to $5 per ton; previously they have paid $10 to $15 per cord for wood.

CALIFORNIA

New Bills Both Good and Bad, Say Mining Companies

San Francisco Correspondence.

Mine operators have considered at length four new bills presented to the California Legislature. The Assembly Bill No. 485 is looked upon with favor. This amends the Act of March 16, 1872, and makes more definite the provisions for a second exit in operating mines. Assembly Bill No. 484, providing for the purchase by the state of the equipment necessary for two mine rescue stations and the maintenance of the stations by the mine operators is also favored. Senate Bill No. 512, providing for the identification and recording of sales of bullion and other products derived from ore is considered necessary legislation. Assembly Bill No. 486, providing for inter-communication between contiguous mines for safety purposes is considered to be impracticable by most mine operators and is therefore met with objection.

Debris Dams Will Help Placer Operators—Power as "Byproduct"

According to Edwin Higgins, staff engineer of The Metals Exploration Co., the Bullard's Bar Dam, now under construction, and the proposed dam at the Narrows near Smartsville, will enable many gravel deposits upon the watershed of the Yuba River to be worked without interference from water-bourn debris to farming or other interests below the dam sites. Not only will water storage be increased but the development of power by hydroelectric plants at both dams will be an important byproduct of the hydraulic mining operations. Before hydraulic mining is resumed old ditches, flumes and pipe lines must be put in condition and new equipment installed. Gravel deposits will be eventually worked at Bloomfield, Columbia Hill and elsewhere on the San Juan ridge and in the vicinity of Smartsville, on Harmony ridge, Omega, Brandy City, Scales, Poverty Hill and other points.

Calaveras Copper Co. Hastens Preparations

The Calaveras Copper Co. is adding more men to its working crew and is rapidly completing plant improvements preliminary to the resumption of ore production. The concentrating mill will soon be ready for operation. A fireproof hoist house at the South Shaft is about completed. The discovery shaft has been sunk to a depth of 1,420 ft. and an ore pocket and station are being cut.

Barytes Property Ships Regularly

William Maguire is shipping barytes from his mine in Nevada County, Calif., to Oakland, where it is used in the manufacture of lithopone and other barium chemicals. The deposit, situated five miles from Alta, on the Southern Pacific railroad, is covered with no overburden; the vein has been developed for 600 ft. and is about 40 ft. wide. The present face is 45 ft. high. During 1922 about 2,000 tons was shipped.

ARIZONA

Completion of Magma Smelter Scheduled for Jan. 1, 1924

Work on the new smelter that is being constructed by Magma Copper Co. at Superior, Ariz., is progressing satisfactorily and, if the present schedule is followed, it is expected to be completed by Jan. 1, 1924. Good progress is being made on the foundation work and the erection of structural steel is to be started early in April. The brick plant is now producing about 25,000 bricks per day and the amount needed for the smelter will be ready by the time the foundation work is finished. It is reported that the company will erect a number of houses near the smelter site to be rented to their employees.

Black Hawk Optioned

The Southwest Leasing and Development Co. have taken a bond and option on the Black Hawk mine, in Cochise County. It is understood that several adjoining claims have also been included in the option. Work will be commenced under the supervision of Harry A. Morse.

Powder Manufacture Increases with Mining Activity

The Apache Powder Co. located between Benson and St. David in Cochise County on the El Paso & Southwestern Railroad is now making and shipping a carload of powder daily. The company began operations during the latter part of 1922 and is one of the new industries of the state. It is estimated that 12,000,000 lb. of powder will be made and disposed of to the mining companies throughout the state this year. The company is financed by various copper mining interests.

OREGON

Amalgamated Mines Plans to Start Mill

Resumption of mining operations of the Amalgamated Mines Co.'s property in the Paddy's Paradise section of eastern Oregon will begin April 15. Water power has been developed and the mill will be started on that date with the expectation of milling 100 tons of ore per day. The vein from which the ore is taken varies from 3½ to 5 ft. in width and carries ore worth from $7 to $28 per ton. A new Chilean mill has been installed at the mine. J. A. Gyllenberg, of Baker, heads the company.

IDAHO

Much Capitalization; How About Output?

The Idaho Gold & Ruby Mining Co. operating a large placer deposit near Leonia, recently held a special meeting of its stockholders in Spokane and increased its capitalization from $4,000,000 to $6,000,000. A cash bond will be posted to guarantee the Great Northern Railway Co. against damage which might be caused to the railway at the mouth of Boulder Creek by hydraulic mining operations on the creek.

MONTANA

Anaconda Company Enriches State

A filing fee stated to be $30,375 was paid the State of Montana by the Anaconda Copper Mining Co. on Feb. 28, for the recording of the increase of its capital stock from $150,000,000 to $300,000,000.

Venders of Claims Seek to Foreclose on Boston & Montana

Three suits against the Boston & Montana Development Co. have been filed in the district court of Beaverhead County, at Dillon, for the foreclosure of mortgages held by Frank B. Felts, Joseph C. Smith, and T. D. Olmstead on mining claims held at present in the name of the Boston & Montana company.

The suits are for the purpose of regaining possession of certain mining claims located in the Elkhorn mining district in this county or for the payment of notes, issued to the plaintiffs in the sum of $211,000, principal and interest, which are protected by mortgages on the mining claims.

Jib Mining Co., Reorganized, Plans Mill

The reorganization of the Jib Mining Co., as the Jib Consolidated Mining Co., promises a renewal of activity in the Basin mining district, which was prosperous thirty years ago. The property controlled by the company consists of the Hope, Jib, Katie, and Last Chance groups. It is state that sufficient stock has been underwritten to provide more than $300,000, and that mill construction will be started immediately. The Hope shaft has been unwatered and mining operations will be resumed.

The Hope and Katie mines were once famous for their high-grade ore shipments. They were located in 1880. The Hope mine was owned by the Bay State Mining Co. which sold it to the Heinze interests. Later the Atwater interests obtained control. The town of Basin, which is dependent on mining, is already showing signs of revival.

NEW MEXICO

Fluorspar Shipped From Silver City

The production of fluorspar has been added to the mining activities of Grant County. The Benperce Mining Co., under the management of B. F. Goodier, has opened the Big Six group, on the Gila River, 6 miles north of Cliff and 38 miles from Silver City, and is now shipping over the Sante Fe.

The fluorspar is said to be the highest grade product yet discovered in New Mexico. A product analyzing 85 per cent calcium fluoride and under 5 per cent silica can be made. Production has started on a basis of 25 tons daily, and is expected to increase. The mineral lies a short distance from the state highway; it is packed on burros over the divide to the road, and is then loaded on trucks and transported over the state highway to Silver City. The company is shipping to Birmingham, Ala., and to Chicago.

43,000,000 Ounces More

Purchases of silver by the Bureau of the Mint during the week ended March 10 amounted to 1,813,000 oz. This brings the total purchases under the Pittman Act to 164,300,674 oz., and leaves about 43,000,000 oz. still to be purchased.

NEVADA

Tonopah Extension Increases Mill Capacity

Additions to the milling plant of the Tonopah Extension Mining Co., which will increase mill capacity from 425 to 500 tons per day, will be completed during the current month. New machinery includes ten stamps, one 5 by 16 ft. tube mill, one 33-ft. settling tank, two 80-ton agitator tanks, one 80-leaf Butters type filter, and necessary zinc boxes.

Montana Tonopah Resumes

The Montana Tonopah Company Reorganized has commenced work along the line outlined in the recent report to stockholders. A new headframe is being placed over the Gipsy Queen shaft and shaft sinking below the 1,500 level will be started as soon as necessary machinery is placed and shaft repairs down to that level are completed.

Bullion Shipments Below Normal

Bullion shipments from the Tonopah district for the last 13 days of February were as follows: Tonopah Belmont $78,000, Tonopah Extension $85,400, West End $68,000, Tonopah Mining $50,000. This makes total bullion produced during February about $550,000, or about ten per cent below normal, due partly to February being a short month.

ARKANSAS

Manganese Ore Being Shipped

The American Ore Corporation is developing a manganese mine near Independence. A sheet of ore covering two acres and from 8 to 12 ft. thick has been proved although none of the test holes have delimited the deposit. The corporation has just closed a twelve months contract for the sale of all its manganese to the Tennessee Coal, Iron & Ry. Company. It has put in charge of the manganese property Oliver Grettum, formerly with the Arthur Iron Co. of Hibbing, Mich. The corporation has shipped considerable ore to the T. C. I. & R.R. Co., and of an average grade of better than 50 per cent manganese, and expects to maintain this grade.

WASHINGTON

Gladstone Mountain Suspends Shipments Temporarily

Net profits from the operations of the Gladstone Mountain Mining Co., 20 miles east of Northport, are amounting to $10,000 per month. Because of bad roads from the mine to the railroad on account of melting snow, shipments will be temporarily suspended according to Edwin T. Lavigne.

UTAH

Good Start for 1923 Dividends

With the dividend of the Utah Copper for the first quarter of 1923 increased to $1 per share, the Park-Utah, paying its regular dividend, the Park-City Mining & Smelting returning, after an absence, to the dividend list, and the Chief Consolidated paying its usual rate, Utah mines have made an excellent beginning for the year. Now comes the Silver King Coalition dividend for the first quarter of 1923, to be paid March 20. The dividend amounts to $182,415.

MICHIGAN

Employees on Iron Ranges Subscribe for Company Securities

The Cleveland-Cliffs Iron Co., the largest shipper from the Michigan Iron Ranges, to encourage the interest of its employees, has offered the latter an opportunity to subscribe for its bonds, $1,400,000 of which have been set aside for this purpose. Bonds bear a rate of 6 per cent interest. The same company offered its employees $3,500,000 in 1915. Of that amount all but the sum being offered at the present time have been retired or expired unissued.

The offering of stock by the Oliver Iron Mining Co. (United States Steel), to its employees at $107 per share, was liberally subscribed to by the employees of the company throughout the Lake Superior region.

Mechanical Loaders Win Favor

Greater interest than ever is being shown by mine operators in the introduction of labor-saving machinery for underground purposes, and in the adoption of new methods to reduce the cost of mining. Slushers and power shovels for use in the stopes are becoming general in all those places where sufficient room is available for their operation, and greater efficiency in all departments is the aim of managers.

NEW MEXICO

Disseminated Lead-Silver Ore Found by Core Drilling

Prospecting activities continue in the Tres Hermanas district, south of Deming. Several months ago a core drill was started upon the Waterloo property, owned by S. S. Warren. The orebody, which is a grano-diorite zone, showing disseminated lead-silver sulphides with some copper carbonates, was cut to a depth of 118 ft. where a porphyry flow was encountered. This lasted to 171 ft. in depth, when the orebody was again encountered, showing the same characteristics but being of somewhat higher value. The drill has reached a depth of 225 ft. It is the intention to carry the hole to a depth of 500 ft. A new company financed by California people has been formed to handle this work, absorbing the rights of the Ramona mining company. It will be known as the Natzar Mining Co. It is reported that $20,000 has been spent so far, by the new company.

THE MARKET REPORT

Daily Prices of Metals

Mar.	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
8	16.50 @16.75	45.25@45.625	47.25	8.25	8.30@8.40	7.50@7.75
9	16.50 @16.75	45.75@46.125	48.00	8.25	8.25@8.35	7.50@7.75
10	16.50 @16.75	46.25	48.50	8.25	8.25@8.35	7.50@7.75
12	16.50 @16.75	47.00@47.75	49.50	8.25	8.25@8.35	7.50@7.75
13	16.625	49.25@49.625	51.25	8.25	8.25@8.30	7.50@7.85
14	16.625@16.75	47.75@48.00	50.00	8.25	8.25	7.70@7.85

*These prices correspond to the following quotations for copper delivered: March 8th to 12th inc., 16.75@17c.; 13th, 16.875c.; 14th, 16.875@17c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin quotations are for prompt deliveries. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

March	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
8	72 3/8	73 1/8	80 3/4	213 3/4	214 1/2	29 3/8	29 1/8	36 5/8	36 7/8
9	72 3/8	73 1/4	80 1/2	217 1/4	217 3/4	29 3/8	29	36 3/4	36 3/8
12	72 5/8	73 1/8	80 1/2	224 1/2	224 1/2	29 1/8	28 3/4	36 3/8	36 1/4
13	72 1/2	73 3/8	80 1/2	234 1/4	234 1/2	29	28 3/4	36 7/8	36 3/4
14	73 5/8	74 1/8	80 3/4	224 3/4	224 3/4	28 5/8	28 3/4	37	36 7/8

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Mar.	Sterling Exchange "Checks"	Silver			Mar.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
8	4.69 5/8	99 5/8	66 3/4	31 15/16	12	4.70 3/8	99 5/8	68 1/4	32 11/16
9	4.70 1/2	99 5/8	67	32 1/16	13	4.70	99 5/8	67 1/2	32 1/4
10	4.70 3/8	99 5/8	67 1/4	32 3/16	14	4.69 1/2	99 5/8	68 1/8	32 5/8

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets

New York, March 14, 1923

The week has been more quiet than usual in the metal markets though this does not reflect any decrease in the activity of manufacturing interests who continue to be doing a phenomenal business. In fact, there is practically no line of metal consumption that has yet experienced a reaction.

Copper

Practically all producers continue to hold their copper at 17c. delivered but have done an insignificant amount of business at that level since last Thursday. Several million pounds of copper for forward delivery were sold at 16.75c. but we have no knowledge of any seller willing to release metal at that figure today. A large consumer reported that 16⅞c. was the best that he could do this morning and that only limited lots were available at this level. However, with an almost entire absence of demand this price may be regarded as the market. There is no sign of weakening among most producers from the 17c. quotation, and, being well sold up, they seem willing to wait two or three weeks if necessary for the demand to reassert itself.

The export market has also been more quiet than usual, at prices that have netted producers approximately the same as domestic business.

Lead

The official contract price of the American Smelting & Refining Co. remains at 8.25c., New York.

The lead market has had a quiet week punctuated by an interesting development in St. Louis where one of the principal producers lowered his prices sufficiently to disconcert buyers and some fellow producers. The reduction was made because of an anticipated increase in April production, and in an effort to bring the St. Louis and New York markets into a more normal relationship. The price reduction evidently caused prospective consumers to withdraw from the market in an attitude of "watchful waiting," for inquiries have fallen off. The London market has also declined and today for the first time since May 2, 1921 a contango exists. This is partly explained by the arrival of Mexican lead which has depressed the price of spot metal somewhat.

The conditions which account for the present high price of lead are still actively at work and there has been no fundamental change in the situation. Today common grades of lead can readily be obtained for either March or April shipment at 8.25c. per lb. in both New York and St. Louis. Corroding grades in the Middle West have been sold for as much as $4 per ton premium. Premiums are also asked for spot lead, which is in relatively insignificant demand, and also on some sales to dealers, prices as high as 8.40c. having been paid by dealers in the New York district during the week. This is because of the aversion of most producers to sell to other than consumers.

Zinc

Buying has not been particularly active, the slight increase in price no doubt being a reflection of the favorable statistics issued by the American Zinc Institute for February. These show stock on hand Feb. 1, 16,574 tons; produced during February, 42,443; shipped, 48,153; leaving stock on hand Feb. 28, 10,864 tons. Shipped from plant for export, 2,636. Number of retorts operating, 86,931.

During the week, galvanizers have been the principal purchasers of Prime Western grade and sales have been well divided between prompt deliveries and for succeeding months up to June. The high range shown in the quotation is for prompt and the low for June. Brass special has been in great demand, particularly for prompt delivery, during the last day or two, and yesterday sold for 8.10c. High-grade is in good demand at 8.75@9c. delivered in the East.

Tin

The tin market has fluctuated wildly owing to the machinations of London speculators. Buying here has been spotty with a scramble for the tin when the price was at a peak. Many of the orders were for dealers' account. It is said on good authority that reports that the Far Eastern stocks have been taken over by consumers in this country are in error. The Federated Malay States government is well able to hold them indefinitely, having become prosperous through the sale of rubber, so it is said.

Arrivals of tin, in long tons: March 7th, London, 25; Straits, 5; 9th, China, 14; 12th, London, 218; China, 100. Total so far in March, 2,937.

Gold

Gold in London: March 8th, 88s. 3d.; 9th, 88s. 2d.; 12th, 88s.; 13th, 88s. 8d.; 14th, 88s. 8d.

Foreign Exchange

Foreign exchanges have moved within narrow limits with slightly lower tendencies except for sterling. On Tuesday, March 13, cable quotations on francs were 6.0375c.; lire, 4.7775c.; marks, 0.0048⅝c.; and Canadian dollars, 2 per cent discount.

Silver

The market has showed renewed strength the last week, due to further purchases for account of China and the Indian Bazaars. On March 13th, the London price declined sharply on account of re-sales from India, but this weakness was not reflected in the New York market, as China orders for San Francisco delivery advanced the price well above London parity. The market closes quiet.

Mexican Dollars—March 8th, 51; 9th, 51⅛; 10th, 51⅜; 12th 52⅛; 13th, 51½; 14th, 52.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—General market for 99 per cent grade, 25½@26c. per lb.; 98 per cent, 24½@25c. London quotations, £92@£100.

Antimony — Chinese and Japanese brands, 8¾@9c. W.C.C., 9¼c. Cookson's "C" grade, spot, 10@10⅝c. Chinese needle antimony, lump, nominal, 6c. per lb. Standard powdered needle antimony, 200 mesh, at 6½@7c. per lb. White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, 8@8½c.

Bismuth—$2.55 per lb. London, 10s.

Cadmium — $1.10 per lb. London quotes 4s. 6d. @ 5s. 6d.

Iridium—$260@$275 per oz.

Nickel—25@30c. per lb. for 99 per cent virgin metal.

Monel Metal—Shot and blocks, 32c. per lb.; ingots, 38c.; f.o.b. W. Va.

Osmium—$80@$85 per oz., Los Angeles.

Palladium—$79 per oz.

Platinum—$110 per oz.

Quicksilver—$70 per 75-lb. flask. San Francisco wires $69.65. London £10.

Ruthenium—$40@$45 per oz.

Selenium—$2 per lb.

The prices of **Cobalt, Molybdenum, Radium, Rhodium, Tellurium** and **Thallium** are unchanged from prices given March 3.

Metallic Ores

Chrome Ore—Indian chrome ore, $20.50 per ton, c.i.f. Atlantic ports. Rhodesian and New Caledonian, $24@$26 per ton.

Manganese Ore—33c. per long ton unit, seaport, plus duty. Chemical ore, $75@$80 per gross ton.

Molybdenum Ore—65@70c. per lb. of MoS_2 for 85 per cent MoS_2 concentrates.

Tungsten Ore—Wolframite, $7.75@$8; scheelite, $8.50@$9 per unit of WO_3, f.o.b. New York.

Iron Ore, Magnetite, Tantalum, Titanium, Uranium, Vanadium, and **Zircon Ore** are unchanged from the quotations published March 3.

Zinc and Lead Ore Markets

Joplin, Mo., March 10—Zinc blende, per ton, high, $49.40; basis 60 per cent zinc, premium, $49; Prime Western, $47.50@$48; fines and slimes, $47@$44; average settling price, all grades of blende, $46.87.

Lead, high, $122.10; basis 80 per cent lead $120@$121; average settling price, all lead ore, $113.58 per ton.

Shipments for the week: Blende, 19,786; lead, 1,401 tons. Value, all ores the week, $1,086,460.

Lead sold early in the week on a basis price of $120 per ton, and tonight buyers said they would not know this week's market until Monday. Rumors of offers of $121 are current. The smelters have about 20,000 tons of zinc ore purchased and undelivered, representing a considerable part of the tonnage in bins.

Platteville, Wis., March 10—Blende, basis 60 per cent zinc, $51 per ton. Lead, basis 80 per cent lead, $120 per ton. Shipments for the week: Blende, 899 tons; lead, none. Shipments for the year: Blende, 7,618; lead 145 tons. Shipments for the week to separating plants, 893 tons blende.

Non-Metallic Minerals

Asbestos—Crude No. 1, $500; No. 2, $250@$325; long spinning fibers, $135@$200; magnesia and compressed sheet fiber, $100@$150; shingle stock $65@$85; paper stock, $35@42; cement stock, $20@$25; shorts, $9@$14—all per short ton, f.o.b. mines, Quebec, Canada.

Rhodesian No. 1 crude, $375; No. 2, $250; inferior grade, $200—all c.i.f. Atlantic ports per short ton.

Magnesite — Dead-burned magnesite grains, $40 per net ton, f.o.b. Baltimore; $40@$42, Chester, Pa.

Crude, $14 per ton; 85 to 90 per cent MgO calcined lump, $32.50@$38 per ton; calcined ground, in paper sacks, 90 per cent through 200 mesh, $44@$48 per ton—all f.o.b. California points.

Grecian caustic-calcined and ground, $51@$52 per ton, f.o.b. cars, Atlantic seaboard.

Bauxite, Barytes, Chalk, China Clay, Diatomaceous Earth, Emery, Fluorspar, Fuller's Earth, Graphite, Gypsum, Limestone, Manjak, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, Sulphur, and **Tripoli** are unchanged from the March 3 prices.

Mineral Products

Arsenious Oxide (white arsenic)—14@15c. per lb.

Sodium Sulphate—$26@$28 per ton.

Potassium Sulphate, Sodium Nitrate, and **Copper Sulphate** are unchanged from quotations of March 3.

Ferro-Alloys

Ferromanganese — Domestic, 78@80 per cent, $102.50@$107.50 per gross ton, f.o.b. furnace. Spiegeleisen, 19@21 per cent, $40, f.o.b. furnace; 16@19 per cent, $39.

Ferrosilicon—50 per cent $86@$89 per gross ton, delivered.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrotitanium, Ferrotungsten, Ferro-uranium, and **Ferrovanadium** are unchanged from the prices published March 3.

Metal Products

Copper Sheets—Base price, 24¾c. per lb. Wire, 19½c.

Nickel Silver—30¼c. per lb., for 18 per cent nickel Grade "A" sheets.

Yellow Metal — Dimension sheets, 22⅜c. per lb.; rods, 19⅛c. per lb.

Zinc Sheets—Base price, $9.65 per 100 lb., East St. Louis.

Lead Sheets—Full, $10.25; cut, $10.50 per 100 lb.

Refractories

Bauxite Brick, Chrome Brick, Chrome Cement, Magnesite Brick, Magnesite Cement, Silica Brick and **Zirkite** are unchanged from the March 3 prices.

The Iron Trade

Pittsburgh, Mar. 13, 1923

Steel Corporation unfilled tonnage increased 373,213 tons in February.

Steel ingot production was at about 40,000,000 tons a year in the last three months of last year, 43,500,000 tons in January and 44,000,000 tons, as an average, in February, while this month is likely to show a rate well above 45,000,000 tons.

Pig Iron — Prices have advanced sharply in the week. In foundry and basic the jump from $28.50 to $30 was made without any sales at intermediate prices. The market is now $30, Valley, on bessemer, basic, and foundry, with practically certain prospects of still higher prices within a few days.

Connellsville Coke—As part of the recent movement in second-quarter furnace coke there has been some additional contracting, at $7 and $7.25. Prospective production is now taken. A dozen or more Connellsville steam coal mines have closed on account of low prices, not more than $2 being obtainable. Byproduct coal is strong and active at $2.75@$3.50.

Lead Market in an Excellent Position

Tight Metal Situation Brings About Peculiar Conditions—Consumption Well Diversified and Strong—Spanish and Australian Production Lagging Behind American and Mexican—Foreign Importations of Great Importance in Influencing Prices

By Felix Edgar Wormser
Assistant Editor

PERHAPS you have repainted your house, bought a storage battery for your radio, had a telephone installed, gone shooting a little more this year. If so, you have been partly responsible for the great improvement in the price of lead that has occurred in the last seven months, an improvement that placed its value, at times, a cent and one-half per pound above that of zinc. Enough lead has not been produced by the world's mines to supply the demand, and those companies in the United States and elsewhere that have been able to produce the metal continuously have indeed "made hay while the sun shines." The increased dividend rates or the extras declared by some companies are signs that lead mining is highly prosperous.

The market situation is most unusual. Lead is as cheap in New York as in St. Louis, although St. Louis is closer to the important lead districts of the Middle West. Lead is cheaper to the British consumer by more than two cents than to the consumer in the United States, yet only a small amount of lead is produced in the British Isles. These discrepancies will sooner or later adjust themselves, as they are not normal, but how the change is to take place cannot be easily forecast.

In accounting for the present state of the market, the production of Mexico has been extremely influential. The lead output of Mexico acts somewhat as a stabilizer between London and New York lead prices. This it can do because it costs only about $1 per ton more to ship a large proportion of lead by water from Mexico to the United States than to British and Continental ports. Consequently, when the price of lead in London, making allowance for exchange and the tariff, is greater than the price of lead in New York, the Mexican supply steams to Europe and vice versa.

The differential between the London and New York markets, when reduced to a common basis, is an index of the marine routing of Mexican lead. When Mexican lead arrives in New York it has a tendency to depress the market locally, giving rise to the abnormal relation between the New York and St. Louis markets referred to above. The normal difference between the two American market centers represents the cost of shipping lead from the Middle West to the Atlantic seaboard—about 35c. per 100 lb., which is added to the New York price. A few days ago, St. Louis lead was 15 to 20c. per 100 lb. higher than New York. There is a limit to the extent to which this differential can grow, as imported lead can be shipped from the coast to the west, or Mexican lead can travel up the Mississippi Valley from the border to relieve the shortage. Signs are not wanting that this action is occurring and that the St. Louis market is declining from the pressure of unlooked for supplies and new production. The present market has put consumers in the Middle West at a disadvantage compared with those in the East owing to the fact that many of their contracts which run for long periods have been drawn up with a normal relation between the St. Louis and New York markets in mind. When the St. Louis market is above New York the middle western consumer includes in his payment for lead not only the freight from St. Louis to his manufacturing point but also the abnormal advance of St. Louis above New York. A tendency toward lower prices in the western market would help the consumers there.

Of late the New York market has been receiving the bulk (about 75 per cent) of the output below the Rio Grande, which, incidentally, is reaching record proportions. Current production of lead in Mexico is estimated to be 18,000 tons monthly including lead in ore and concentrates, with a 20,000-ton rate in sight. For the last ten years political disturbances in Mexico have kept production irregular and low. In 1916 it was only 2,000 tons monthly and last year it averaged perhaps 10,000 tons. The present rate is excellent, with producers bending every effort to maintain or increase it.

The price of lead at 8.25c. New York is high—too high, some producers freely admit. It is about 85 per cent above the five-year pre-war average of 4.40c. per lb., but the market is strong and no change is noticeable in the fundamental conditions that have brought about the great rise in price. Will production overtake consumption or will consumption be affected by the high prices? At the moment the four chief consuming branches show no signs of becoming satiated. Paint business is splendid, the corroders being stimulated by the building boom; cable manufacturers have orders on their books enabling them to operate for months without apprehension; sales of storage batteries are excellent and reflect the buying of automobiles and radio apparatus. Even the ammunition factories are calling for large quantities of the metal.

Except in the United States and Mexico the high price of lead has not been instrumental in bringing out a greater world's production to relieve the shortage. Spain and Australia, the two other major lead-producing countries, are bothered with labor difficulties—profiting neither capital nor labor—but greatly decreasing production at a time when it is highly advantageous to increase it. Ten years ago Spanish lead output was about 18,000 tons per month, whereas the present rate is reported to be between 8,000 and 9,000 tons. There is room for a large increment in this rate. Australian production is close to a normal rate of around 10,000 tons monthly, and is estimated at 8,500 tons. An increase may be expected, but none of large proportions until some labor adjustments have been made. The lead mining, smelting and refining capacity of Australia has been estimated at 200,000 tons per year, and it has been reported that the Broken Hill companies paying dividens are enabled to do so from the revenue derived from the sale of zinc concentrates to the British Government under a favorable contract, and not from a profit on their lead. Australia has not seized the opportunity presented by the high lead prices. Excessive cost of production, burdensome working conditions, and shorter working hours have contributed to the industrial difficulties.

The lead production of Burma is comparatively small, 3,500 tons per month being mined and smelted, which is close to the capacity of the plant. Burmese lead and some of Australian origin is sold directly to Far Eastern manufacturers, and influences the London market only indirectly.

The high price of lead has allowed producers to dispose of their stocks completely, and current production has generally been contracted for early in each month. Producers are usually averse to selling lead for delivery in the future.

Reports from abroad indicate that the rise in the price of lead is held to be part of the "inflation" that is going on in the United States at the moment. This view is tenable when it is considered in its relation to the upward trend of practically all commodities in the country, but it ignores the great demand for lead in this country and the fact that production has been unable to keep pace with consumption.

The lead market has not been speculative. It is hardly fair to say there has been inflation when stocks are negligible and plant extensions are constantly being planned to provide larger manufacturing facilities and hence a stronger demand for lead. The telephone industry alone consumes about 18 per cent of the domestic lead production at present, and is a branch of American business that is constantly growing and bids fair soon to surpass the Steel Corporation in size. If the forces that produce inflation—excessive gold stocks, restrictive immigration laws, and a high tariff—are at work, then lead may show their effect, but one doesn't have to go so far afield to understand the reason for the high price.

COMPANY REPORTS

Hecla Mining Co.

Silver, Lead; Burke, Idaho

A report of the operations of Hecla Mining Co. for 1922 shows a net profit of $1,359,889.45, according to the following income account:

INCOME		
Ore sales—net receipts	$2,592,292.61	
Interest	46,271.90	
Rents	10,850.09	
Miscellaneous	1,205.93	
		$2,650,620.53
EXPENDITURES		
Mining and development	$812,832.53	
Ore sorting	37,900.95	
Ore hauling—mine to mill	38,908.44	
Milling	103,449.19	
Miscellaneous	166,717.40	
		1,159,808.51
		$1,490,812.02
Net income		
Depreciation reserves	$120,625.79	
Depletion	10,296.78	
		130,922.57
		$1,359,889.45
Net profit		
Dividends	$950,000.00	
Taxes—Federal income, 1909, to 1918, inclusive, and 1922, and state net profit	485,006.27	
		1,435,006.27
Drawn from surplus		$75,116.82
Surplus, Dec. 31, 1921		2,123,219.57
Surplus, Dec. 31, 1922		$2,048,102.75

Balance sheet as of Dec. 31, 1922, is given as follows:

ASSETS		
Current assets		$1,522,044.37
Working assets		132,711.07
Investments—		
Sullivan Mining Co.		273,106.35
Total fixed assets	$1,872,781.16	
Less depreciation reserves	918,414.97	
		954,366.19
		$2,882,227.98
LIABILITIES		
Current liabilities		$584,125.23
CAPITAL AND SURPLUS		
Capital stock	$250,000.00	
1,000,000 shares, par value 25c., all issued and fully paid.		
Earned surplus	2,048,102.75	
		2,298,102.75
		$2,882,227.98

Production amounted to 42,490,476 lb. of lead and 1,178,124 oz. of silver.

Utah Copper Co.

A statement covering the result of operations of the Utah Copper Co. for the fourth quarter of 1922 states that the net production of marketable copper derived from this gross output, after allowing for smelter deductions, was 31,495,654 lb., compared with 30,767,766 lb. for the previous quarter. During the quarter the Arthur plant treated 1,522,600 dry tons and the Magna plant 126,000 tons, a total for both plants of 1,648,600 dry tons, or an increase of 130,400 tons compared with the previous quarter.

The average grade of ore treated at the mills was 1.25 per cent copper and the average recovery 79.27 per cent, compared with 1.296 per cent and 81.14 per cent, respectively, for the third quarter. The average cost per net pound of copper produced, including all fixed and general charges, and before crediting the value of gold and silver and miscellaneous earnings, was 9.646c. The gold and silver values in the concentrates, plus the miscellaneous income from other sources, amounted to 1.244c. per lb.

The following tabulation shows the financial results of the company's operations for the quarter as compared with the previous quarter:

	Fourth Quarter, 1922	Third Quarter, 1922
Net profit from copper production only	$1,346,287.12	$1,278,505.44
Miscellaneous income, including payment for precious metals	393,962.36	417,156.83
Total income for the quarter	$1,740,249.48	$1,695,662.27

Earnings for the fourth quarter are computed on the basis of 13.895c. per lb. for copper. The quarterly distribution to stockholders on Dec. 30, 1922, was at the rate of 50c. per share and amounted to $812,245.

The total stripping removed during the quarter was 416,896 cu.yd., an average of 138,965 per month, as compared with a total of 461,218 cu.yd. and a monthly average of 153,739 cu.yd. for the preceding quarter.

Chief Consolidated Mining Co.

Silver, Lead; Eureka, Utah

A report of the operations of the Chief Consolidated Mining Co. for 1922 states that the total shipments of ore were 133,790 dry tons, yielding, after all operating charges, $524,325.66. Production was 19,779,418 lb. of lead, 4,437,033 oz. of silver; 957,825 lb. of copper. and 11,931 oz. of gold. Balance sheets as of Dec. 31, 1922 is as follows:

ASSETS			
Mining claims—cost		$2,387,650.96	
Machinery and equipment		648,293.21	
			$3,035,944.17
Mine Investments (at or below cost)			
Plutus Mining Co.'s stock		$99,888.52	
Other investments		502,893.05	
			602,781.57
Current assets		$164,641.12	
Subsidiary companies' balances			
Plutus Mining Co.	$84,753.88		
Eureka Lily Mining Co.	7,561.42		
Apex Standard Mining Co.	57,416.93		
Eureka Hill Mining Co.	25,558.41		
		$175,290.64	
Supplies		46,465.31	
Miscellaneous		12,317.83	
			398,714.90
Liberty Bonds Investment			510,847.24
Cash			39,236.23
			$4,587,524.11
LIABILITIES			
Capital stock:			
1,000,000 shares at $1		$1,000,000.00	
Less stock in treasury		110,775.00	
			$889,225.00
Stock premium			23,715.00
Surplus Dec. 31, 1921		$1,827,632.93	
Profits, 1922			
Gross receipts from sales of ore and lime rock	$3,113,415.07		
Less operating costs and for reserves for taxes and development of properties of subsidiary companies and miscellaneous profit-and-loss items, but exclusive of depletion	$2,589,089.41		
Net earnings	$524,325.66		
Interest on investments and deposits	30,092.17		
	$554,417.83		
Less dividends 31, 32, 33 and 34	265,302.20		
		289,115.63	
Surplus Dec. 31, 1922			2,116,748.56
Bills payable			364,182.00
Current liabilities			195,170.76
Reserve accounts			
Reserve for taxes		$579,289.79	
Reserve for depreciation		243,951.12	
Reserve for development of properties of subsidiary companies		175,000.00	
Reserve for hospital fees		241.88	
			998,482.79
			$4,587,524.11

American Smelting & Refining Co.

A report of the operations of the American Smelting & Refining Co. for 1922 shows a net income of $5,918,142. Production was as follows:

	1922	1921	1913
Gold, oz.	1,744,550	1,780,205	2,506,751
Silver, oz.	84,793,931	75,354,443	85,140,272
Platinum and palladium, oz.	1,165	863	1,367
Lead, lb.	252,898	207,612	293,870
Copper, lb.	433,548,000	348,888,000	512,192,000
Spelter, lb.	35,040,000	14,628,614	17,274,000
Nickel, lb.	314,586	120,080	120,702
Tin, lb.	3,766,000	11,915,954	.....
Sulphuric acid, lb.	28,494,000	9,952,000	19,136,000
Arsenic, lb.	11,203,052	5,155,522	3,028,000
Copper sulphate, lb.	2,274,000	2,237,471	7,940,000
Byproduct metals, lb.	12,700,577	3,232,488	1,114,813
Sulphur dioxide, lb.	1,611	154,794	.....

Income account was as follows:

	Year Ended Dec. 31, 1922	Year Ended Dec. 31, 1921
Net earnings from smelting and refining plants	$12,381,844.12	$8,652,332.72
Net earnings from mining properties	2,458,695.40	426,054.15
Other income, net	233,675.48	403,084.76
Net earnings, before deducting general and administrative expenses and corporate taxes	$15,074,215.00	$9,481,471.63
Deduct general and administrative expenses, taxes, etc.	$1,911,324.05	$1,300,501.50
Net income before providing for bond interest, depreciation, obsolescence and depletion, and after all taxes	13,162,890.95	8,180,970.13
Less		
Interest on A. S. & R. Co. 5 per cent first bonds	$1,785,304.58	$1,618,029.64
Interest on Rosita Coal & Coke Co. 6 per cent collateral trust	33,425.67	54,402.78
Depreciation and obsolescence	3,774,089.80	3,713,836.37
Ore depletion	1,651,927.96	1,083,760.23
Totals	$7,244,748.01	$6,470,029.02
Net income	$5,918,142.94	$1,710,941.11
Deduct		
Dividends on:		
A. S. & R. Co. preferred stock	$3,500,000.00	$3,500,000.00
A. S. S. Co. preferred "A" stock	376,800.00	540,600.00
A. S. S. Co. preferred "B" stock	38,230.00	127,443.75
Net deduction	$3,915,030.00	$4,168,043.75
Surplus income	$2,003,112.94	a$2,457,102.64
Balance at beginning of year	20,322,077.24	25,987,292.65
Totals	$22,325,190.18	$23,530,190.01
Deduct appropriations		
Metal reserve account	$5,823,655.51	
Miscellaneous adjustments of prior years' accounts	1,062,991.60	$3,208,112.77
Totals	$6,886,647.11	$3,208,112.77
Balance at end of year	$15,438,543.07	$20,322,077.24

a Deficit.

Balance sheet as of Dec. 31, 1922, is given as follows:

ASSETS

Property account, cost of plants		$125,347,106.23
Investments		3,398,566.19
Miscellaneous assets		1,764,730.35
Current assets: Total cash, government securities		7,662,092.89
Accounts and notes receivable		7,680,234.71
Materials and supplies	$5,862,714.31	
Metal stocks	40,740,503.00	
Cash and securities in funds	1,364,237.76	
Total current and miscellaneous assets		65,074,513.02
Total assets		$193,820,185.44

LIABILITIES

Bonds outstanding		
A. S. & R. Co. Series A first mortgage		$42,477,700.00
Preferred capital stock outstanding:		
A. S. & R. Co.		50,000,000.00
A. S. S. Co., Series A		1,373,900.00
Series B		286,400.00
Common capital stock outstanding, A. S. & R. Co.		$60,998,000.00
Current accounts, notes, drafts and wages payable		10,303,804.72
Interest on bonds		572,993.53
Dividends		982,929.01
Accrued taxes not due		2,393,263.17
Miscellaneous suspended accounts		1,217,163.27
Reserves		
Employees' fund	$1,951,833.16	
Metal stock	5,823,655.51	
Profit and loss surplus		15,438,543.07
Total liabilities		$193,820,185.44

Facts for the Stockholder

IX—Chino Copper Co.

THE CHINO COPPER CO. was incorporated in Maine, in June, 1909, and acquired the properties of the Santa Rita Mining Co. through an exchange of 375,000 shares of Chino Copper Co. stock for the entire capital stock of the Santa Rita Mining Co. It also has an equal interest with the American Smelting & Refining Co. and Ray Consolidated Copper Co. in the Gallup American Coal Co., with $4,000,000 capital, owning coal fields in the Gallup district of New Mexico. The coal mines have been improved and enlarged.

The company's properties include 214 mining claims, with an area of 3,604 acres, of which 183 claims, with an area of 3,151 acres, are patented. It also owns 120 acres of agricultural land adjacent to the mining claims, and 19,891 acres in connection with its mill location at Hurley and its water rights and tailing-disposal system.

The mine is the old Santa Rita del Cobre, in the Central mining district, Grant County, N. M. The orebody is in a roughly circular shear zone about three-quarters of a mile in diameter, the chief minerals being chalcocite, cuprite, and native copper, with cupriferous pyrites and carbonates in smaller quantity.

Ore reserves are estimated at more than 105,000,000 tons, which indicates an increase over the 95,000,000 tons which obtained for several years. Although the quantity of ore has increased, the average percentage of copper has fallen off from about 1.65 to about 1.53 per cent. Results of milling operations indicate that the average copper in the ore milled was over 2 per cent up to the end of 1915, whereafter it declined to 1.83 in 1916, 1.78 in 1920, 1.7 in 1921, and 1.55 per cent for the bulk of the material mined during the second quarter of 1922. On the other hand, it appears that considerable improvement was made in metallurgical efficiency, for the copper recovered per ton of ore treated increased from 24 lb. in 1919, to 24.93 lb. in 1920, and 26.28 lb. in 1921. The percentage of copper actually recovered from the ore treated increased from 65.67 per cent in 1919 to 77.36 per cent in 1921. However, the record for the third quarter of 1922 was not so good, when the average grade was 1.49 per cent copper.

Chino is one of the large porphyry coppers that is not among the lower-cost producers. During the last five years the costs have been above 14c. a lb. much of the time, the most recent available estimate being around 14.3c.

Equipment includes steam shovels, locomotives, and dump cars, a concentrating mill with a daily capacity of about 12,500 tons, and an electric generating plant near the mill, with a normal capacity of about 5,000 hp.

From the large earnings of $14.76 a share in 1916, and $10.93 in 1917, the earnings fell off to $4.49 in 1918, $1.50 in 1919, $1.52 in 1920, and ran into a deficit in 1921 and 1922. The company's report for the year ended Dec. 31, 1922, shows a deficit of $848,785 after expenses and depreciation, compared with a deficit of $1,314,204 in 1921.

Net assets applicable to the 900,000 shares of capital stock outstanding, $5 par, amount to about $15.80 a share, excluding stripping expenses carried as an asset and amounting to about $6 a share. There is no funded debt. Net working capital has fallen off regularly from about $9,700,000 in 1916 to about $1,200,000 in 1922, current assets standing at $4,745,975 against current liabilities of $3,553,954. It was announced Feb. 15, 1923, that the company had arranged for the sale of 30,000 shares of unissued capital stock for $25 a share, the proceeds to be used in reducing obligations contracted in connection with acquisition of stock and notes of the Gallup American Coal Co. and bonds of the Victor American Fuel Co.

Dividends have been: $2.25 a share in 1913, $2.50 in 1914, $3 in 1915, $8.25 in 1916, $9.90 in 1917, $4.50 in 1918, $3 in 1919, $1.125 in 1920. A last payment, of 37½c. a share, was made on Sept. 30, 1920. Dividend was passed Dec. 3, 1920.

Price range of stock: High, 74 in 1916; low, 16⅜ in 1920; closing price March 3, 1923, 31¾. INVESTIGATOR.

MINING STOCKS

Week Ended March 10, 1923

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	90	79	81½	Dec. '22, Q	$1.00
Alaska-Br. Col.	N. Y. Curb	2⅜	2¼	2⅜		
Allouez	Boston	32	28	29	Mar. '19	1.00
Anaconda	New York	53½	51⅜	52	Nov. '20, Q	1.00
Arcadian Consol.	Boston	4 3/16	3¾	3¾		
Ariz. Com'l	Boston	14	12¼	12¼	Oct. '18, Q	0.50
Bingham Mines	Boston	18	18	18	Sept. '19, Q	0.25
Calumet & Arizona	Boston	66	61⅛	61⅛	Dec. '22, Q	0.50
Calumet & Hecla	Boston	395	375	393	Dec. '22, Q	5.00
Canada Copper	N. Y. Curb	*6	*5	*5		
Centennial	Boston	14½	13	13½	Dec. '18, SA	1.00
Cerro de Pasco	New York	49	46⅞	47	Mar. '21, Q	0.50
Chile Copper	New York	30⅛	29⅛	29⅛		
Chino	New York	31⅛	29⅛	29⅛	Sept. '20, Q	0.37
Copper Range	Boston	46	42⅛	42⅛	Mar. '22, Q	1.00
Crystal Copper	Boston Curb	1⅛	1⅛	1⅛		
Davis-Daly	Boston	4⅛	4⅛	4⅛	Mar. '20, Q	0.25
East Butte	Boston	11⅛	10	10	Dec. '19, A	0.50
First National	Boston Curb	75	70	70	Feb. '19, SA	0.15
Franklin	Boston	2⅛	2⅛	2⅛		
Gadsden Copper	N. Y. Curb	*97	*94	*95		
Granby Consol.	New York	30⅞	29	29½	May '19, Q	1.25
Greene-Cananea	New York	34⅛	33⅛	33⅛	Nov. '20, Q	0.50
Hancock	Boston	4	3	3		
Howe Sound	N. Y. Curb	4	3⅛	3⅛	Jan '21, Q	0.05
Inspiration Consol.	New York	42⅛	39½	40½	Oct. '20, Q	1.00
Iron Cap	Boston Curb	9	8	8⅛	Sept. '20, K	0.25
Isle Royale	Boston	33½	30	30½	Dec. '22, K	0.50
Kennecott	New York	44⅛	42⅛	42⅛	Jan. '23, K	0.75
Keweenaw	Boston	2⅛	2	2⅛		
Lake Copper	Boston	5⅛	4⅛	4⅛		
Magma Copper	New York	37⅞	35⅛	35⅛	Jan. '19, Q	0.50
Mason Valley	N. Y. Curb	2⅛	2⅛	2⅛		
Mass Consolidated	Boston	4	3½	3½	Nov. '17, Q	1.00
Miami Copper	New York	30⅛	28	28⅛	Feb. '23, Q	0.50
Michigan	Boston	3⅛	2⅛	3		
Mohawk	Boston	67	63⅛	63⅛	Nov. '22, Q	1.00
Mother Lode Con.	New York	13⅛	12⅛	12⅛	Dec. '22, K	0.50
Nevada Consol.	New York	18⅛	17	17	Sept. '20, Q	0.25
New Cornelia	Boston	24⅛	22	22	Feb. '23, Q	0.25
North Butte	Boston	12⅛	10⅛	10⅛	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	1⅛	*75	*97		
Old Dominion	Boston	32½	28⅛	28⅞	Dec. '18, Q	1.00
Osceola	Boston	45⅛	40⅛	41⅛	Dec. '22, K	1.00
Phelps Dodge	Open Mar.	†180	†170		Jan. '23, Q	1.00
Quincy	Boston	49⅛	45½	45½	Mar. '20, Q	1.00
Ray Consolidated	New York	17	15⅛	15⅛	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	2⅛	1⅞	2⅛		
St. Mary's Min. Ld.	Boston	51	49	49½	Mar. '23, K	3.00
Seneca Copper	Boston	11⅞	11⅛	11⅛		
Shannon	Boston	1⅜	1	1	Nov. '17, Q	0.25
Shattuck Arizona	New York	10⅛	9⅛	9⅛	Jan. '20, Q	0.25
South Lake	Boston	†1	†*60	*50		
Superior & Boston	Boston	3	2⅛	2⅛		
Tenn. C. & C. cfs.	New York	12⅛	12⅛	12⅛	May '18, I	1.00
Tuolumne	Boston	*53	*48	*48	May '13,	0.10
United Verde Ex.	N. Y. Curb	*33	*31⅛	*32⅛	Nov. '22, Q	0.25
Utah Consol.	Boston	3	2⅛	2⅛	Sept. '18,	0.25
Utah Copper	New York	76⅛	73	73	Dec. '22, Q	0.50
Utah Metal & T.	Boston	1 1/16	1⅛	1⅛	Dec. '17,	0.30
Victoria	Boston	2⅛	2	2		
Winona	Boston	1⅛	1⅛	1⅛		
Wolverine	Boston	12⅛	11⅛	11⅛		
NICKEL-COPPER						
Internat. Nickel	New York	16⅛	15⅛	15⅛	Mar. '19,	0.50
Internat. Nickel, pfd.	New York	77	77	77	Feb. '23, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh			5⅛		
National Lead	New York	134	130	130	Dec. '22, Q	2.00
National Lead, pfd.	New York	113⅛	113⅛	113⅛	Dec. '22, Q	1.75
St. Joseph Lead	New York	22⅛	21⅛	22⅛	Dec. '22, Q,X	0.50
ZINC						
Am. Z. L. & S.	New York	18⅛	17⅛	17⅛	May '20,	1.00
Am. Z. L. & S. pfd.	New York			57⅛	Nov. '20, Q	1.50
Butte C. & Z.	New York	11⅛	9⅜	10	Mar. '23,	0.50
Butte & Superior	New York	36⅛	34⅛	34⅛	Dec. '22,	0.50
Callahan Zn-Ld	New York	11⅛	10⅛	10⅛	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	179	175⅛	177	Feb. '23, Q	2.00
Yellow Pine	Los Angeles	*73	*72⅛	*73	Sept. '20, Q	0.03
SILVER						
Batopilas Mining	New York	⅜	¼	½	Dec. '07, I	0.12½
Beaver Consol.	Toronto	41½	41	41	May '20, K	0.03
Candelaria	N. Y. Curb	*26	*21	*22		
Coniagas	Toronto			2.15	May '21, Q	0.12½
Crown Reserve	Toronto	48⅛	43	48⅛	Jan. '17,	0.05
Hilltop-Nev.	N. Y. Curb.	1⅛	1⅛	1 1/16		
Kerr Lake	N. Y. Curb	3	3	3	Jan. '23, Q	0.12½
La Rose	Toronto	*39	*30	*30	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*22	*20½	*21	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	2.50	1.80	2.50	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	6	6	6	Jan. '23, Q,X	0.60
Ontario Silver	New York	6½	6	6½	Jan. '19, Q	0.50
Temiskaming	Toronto	*38½	.*31½	*38½	Jan. '20, K	0.04
Trethewey	Toronto	*5	*4	*4	Jan. '19,	0.05

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	⅛	⅛	⅛		
Alaska Juneau	New York	1⅛	1⅛	1⅛		
Atlas	Toronto	13	12½	12½		
Carson Hill	Boston	9⅛	8⅛	8⅛		
Cresson Consol. G.	N. Y. Curb	2 1/16	2⅛	2⅛	Jan. '23 Q.	0.10
Dome Mines	New York	41⅛	41	41	Jan. '23, Q	0.50
Golden Cycle	Colo. Springs	1.02	1.00	1.01	Dec. '22, Q	0.02
Hollinger Consol.	Toronto	13.90	13.45	13.65	Feb. '23, M	0.05
Homestake Mining	New York	70	68	69	Feb. '23, M	0.50
Keora	Toronto	*11	*9½	*10⅜		
Kirkland Lake	Toronto	*51⅛	*51	*51⅛		
Lake Shore	Toronto	3.73	3.64	3.64	Nov. '22, Q	0.02
McIntyre- Porcupine	Toronto	20	19	19	Jan. '23, K	0.25
Porcupine Crown	Toronto	*14	*13⅛	*13⅛	July '17,	0.03
Portland	Colo. Springs	†*40	†*30	*38	Oct. '20, Q	0.01
Schumacher	Toronto	*30	*30	*30		
Teck Hughes	Toronto	*98	*94	*97½		
Tom Reed	Los Angeles	1.27	1.12	1.16	Dec. '19,	0.02
United Eastern	N. Y. Curb	2 1/16	2⅛	2 1/16	Jan. '23, Q	0.15
Vipond Cons.	Toronto			*75		
White Caps Mining	N. Y. Curb			*8		
Wright-Hargreaves	Toronto	3.29	3.18	3.28	Jan. '23,	0.02½
Yukon Gold	N. Y. Curb	*80	*80	*80	June '18,	0.02½
GOLD AND SILVER						
Boston-Mont. Corp.	N. Y. Curb	*13	*11	*13		
Cons. Virginia	San Francisco	*10½	*10½	*10½		
Continental Mines	N. Y. Curb	5⅛	5⅛	5⅛		
Dolores Esperanza	N. Y. Curb	2½	2½	2½	Jan. '23	2.50
Tonopah Belmont	N. Y. Curb	1 1/16	1 1/16	1 1/16	Jan. '23, Q	0.05
Tonopah Divide	N. Y. Curb	*89	*71	*74		
Tonopah Extension	N. Y. Curb	4	3⅛	3 11/16	Jan. '23, Q	0.05
Tonopah Mining	N. Y. Curb	2 1/16	2	2 1/16	Jan. '23, SA,	0.15
West End Consol.	N. Y. Curb	1 1/16	1 1/16	1⅛	Dec. '22, Q	0.05
SILVER-LEAD						
Caledonia Mng.	N. Y. Curb	*7	*7	*7	Jan. '21, M	0.01
Cardiff M. & M.	Salt Lake	*31	*31	*31	Dec. '20,	0.15
Chief Consol.	Boston Curb	5	4⅛	5	Feb. '23, Q	0.10
Columbus Rexall	Salt Lake	*20	*19½	*19½	Aug. '22,	0.03
Consol. M. & S.	Montreal	30½	27⅛	29½	Oct. '20, Q	0.62½
Eagle & Blue Bell	Boston Curb	†3½	†2	2⅛	Nov. '22, K	0.05
Federal M. & S.	New York			11	Jan. '09,	1.50
Federal M. & S. pfd.	New York	54	52½	53½	Dec. '22, Q	1.25
Florence Silver	Spokane	*38	*38	*38	Apr. '19,	0.01½
Hecla Mining	N. Y. Curb	9	8⅛	8⅛	Dec. '22, Q,X	0.50
Iron Blossom Con.	N. Y. Curb	*33	*31	*32	Apr. '22, Q	0.02½
Marsh Mines	N. Y. Curb	*9	*8	*8	June '21, I	0.02
Park City	Salt Lake	3.75	3.60	3.70	Jan. '23,	0.10
Prince Consol.	Salt Lake	*10⅛	*8⅛	*9⅛	Nov. '17,	0.02½
Silversmith	Spokane	*48	*45	*47	Oct. '22,	0.01
Simon Silver Lead	N. Y. Curb	*31	*30	*30		
Tamarack-Custer	Spokane	1.65	1.60	1.65	Jan. '21, K	0.04
Tintic Standard	Salt Lake	2.95	2.85	2.87½	Dec. '22, Q,X	0.10
Utah-Apex	Boston	4⅛	4⅛	4⅛	Nov. '20, K	0.25
IRON						
Bethlehem Steel "B"	New York	71⅛	69	69	Jan. '23	0.25
Char. Iron	Detroit			2½		
Char. Iron, pfd	Detroit			2½		
Colorado Fuel & Iron	New York	30⅞	29½	30	May '21	0.75
Col. Fuel & Iron, pfd.	New York	102	102	102	Feb. '23 Q	2.00
Gt. North'n Iron Ore	New York	35⅛	33	33⅛	Dec. '22	1.00
Inland Steel	N. Y. Curb	47⅛	47⅛	47⅛	Mar. '23	0.25
Mesabi Iron	N. Y. Curb	11⅛	10⅛	10⅛		
Replogle Steel	New York	29½	28	28		
Republic I. & S.	New York	62⅛	59	60	May '21	1.50
Republic I. S., pfd.	New York	95⅛	94⅛	95⅛	Jan. '22	1.75
Sloss-Sheffield S. & I.	New York	55½	52⅛	54⅛	Feb. '21	1.50
U. S. Steel	New York	108⅛	107⅛	107⅛	Dec. '22	1.25
U. S. Steel, pfd.	New York	120⅛	119⅛	119⅛	Feb. '23	1.75
Virginia I. C. & C.	New York	68	63⅛	63⅛	Jan. '22	1.50
Virginia I.C.&C.,pfd.	New York	81⅛	81⅛	81⅛	Jan '23	2.50
VANADIUM						
Vanadium Corp.	New York	43⅛	41⅛	41⅛	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	71	69⅛	69⅛	Oct. '22, Q	1.50
Asbestos Corp. pfd.	Montreal	90⅛	89⅛	90	Oct. '22, Q	1.75
SULPHUR						
Freeport Texas	New York	20⅛	19⅛	19⅛	Nov. '19, Q	1.00
Texas Gulf	New York	61⅛	59⅛	59⅛	Dec. '22, QX	2.00
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	4⅛	4	4		
MINING, SMELTING AND REFINING						
Amer. Metal	New York	55⅛	53⅛	54	Mar. '23, Q	0.75
Amer. Metal pfd.	New York	117	115⅛	115⅛	Mar. '23, Q	1.75
Amer. Sm. & Ref.	New York	68⅛	65⅛	65⅛	Mar. '21, Q	1.00
Amer. Sm.& Ref. pfd	New York	102⅛	101⅛	101⅛	Mar. '23 Q	1.75
U. S. Sm. R. & M.	New York	43	41	41	Jan. '21, Q	0.50
U.S. Sm.R.& M. pfd.	New York	46⅛	45⅛	45⅛	Jan. '23 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Arthur E. Moysey; Spokane, Pohlman Investment Co; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, Colorado Springs Stock Exchange.

NEW MACHINERY AND INVENTIONS

The Hoffmann Roller Bearing

In bringing to the American market the Hoffmann roller bearing, the Norma Co. of America, Long Island City, N. Y., is not introducing a new or untried product. For some years this bearing has been manufactured by the Hoffmann Manufacturing Co., Ltd., of Chelmsford, England, and has been known as a high-precision, heavy-duty unit combining all the speed qualities of the best ball bearing with a load capacity said to be beyond that of any ball bearing of equal dimensions.

The successful application of high-precision methods to roller bearing manufacture, in the Hoffmann type, extends almost indefinitely the field of anti-friction bearings, and opens up new avenues to the important economies to be realized by reducing bearing friction and the resultant high up-keep costs.

In its fundamentals of design, the Hoffmann roller bearing reveals no radical departure from established practice and other standard types. The outer race or ring is of plain cylindrical form with rectangular cross-section; it has a "flat-line" race-way on which the rollers run. The inner race or ring has a channel cross-section, with narrow rims either side of the "flat-line" race-way to retain the rollers endwise. The rollers are cylindrical, with a length equal to their diameter. They are held in exact parallelism with the shaft and with one another by these rims or shoulders, which are of hardened steel and allow only a very slight clearance for the rollers. The roller cage or retainer is of simple, strong, balanced construction.

The Hoffmann short roller and retainer is said to eliminate the troubles experienced with other types of roller bearings using taper rollers or long rollers of small diameter. It is impossible—particularly at high speeds—to keep such long rollers rotating in parallelism with the shaft, with the result that the rollers wear concave and the retainer or cage is subject to undue and destructive wear, resulting in unsatisfactory bearing performance. This tendency to run "out of true" is said to be minimized in the short roller type.

It is obvious that the Hoffmann roller bearing as described had no end-thrust capacity. Where thrust is to be encountered, it is necessary to hold the inner race and rollers in correct relation to the outer race by means of some locating device. Where the end thrust is small, it may be taken care of by thrust buttons at either end of the shaft. Where the end thrust is large, it is carried either by auxiliary thrust bearings or by "location bearings" of standard ball type and slightly reduced outside diameter, mounted between two roller bearings.

In addition to the standard Hoffmann roller bearing described (a rigidly mounted type), the same general construction is followed in the Hoffmann self-aligning roller bearing. In this device the periphery of the outer race and its two dust-and-dirt-excluding covers, are ground to form one continuous spherical surface fitting a similarly shaped inner surface on the shell or housing. The bearing is thus free to align itself with its opposite members, the dust covers following every movement. This feature permits these covers to be bored with a small running clearance on the clamping sleeve, so that lubricant cannot work out or dust get into the highly finished bearing surfaces.

The following advantages, said to be distinctive of the Hoffmann precision roller bearing, suggest economies:

A running friction about 1/10 that of a well-fitted plain bearing, and a starting friction about 1/800 that of a plain bearing.

A steady load capacity far beyond that of any ball bearing of equal dimensions.

A large temporary overload capacity.

Ability to stand up under shocks and vibrations which no ball bearing could resist.

Speed qualities equal to those of a ball bearing.

No heating and no risk of seizing—the result of the practical elimination of rubbing friction.

No lubrication troubles—the bearing being grease-packed and needing replenishing of lubricant only at intervals of three to twelve months, depending upon the running conditions.

No wear measurable with the finest instruments after years of service—no time and output lost in replacing worn bearings.

INDUSTRIAL NOTES

Railway Roller Bearing Co., 541 Seymour St., Syracuse, N. Y., have changed their corporate name to Rollway Bearing Co., Inc.

Philipp Brothers, Inc., dealers in metals, ores and chemicals, announce the removal of their offices to suite 902-906, Woolworth Building, 233 Broadway, New York City.

Denver Rock Drill Mfg. Co. have established branch offices at Pittsburgh, Pa., St. Louis, Mo., and Pottsville, Pa. Andrews & George Co., Tokyo, are their sales agents in Japan.

The Chicago Pneumatic Tool Co., New York, announce the appointment of H. J. Bradley as branch manager, San Francisco, succeeding J. K. Haigh, who has been transferred to their Chicago branch to resume sales work.

At the annual meeting of the Basic Refractories Inc., Natural Bridge, N. Y., the following officers and directors were elected: President, J. E. Baker; secretary and treasurer, Miss K. B. Hipple; general sales manager, S. W. Stouffler; board of directors, J. E. Baker, V. M. Frey, W. H. Baker, Geo. R. Shenberger, A. Furst and W. L. Clemons.

TRADE CATALOGS

Gasoline Locomotives — McFarlane-Eggers Machinery Co., Denver, Col. have issued a 4-page leaflet which describes a four-wheel drive gasoline locomotive in which the standard "Fordson" tractor engine is used.

Water Softeners — Graver Corporation, East Chicago, Ind., have just issued Bulletin 509 which describes the process and equipment used in the Graver "zeolite" water softening system. This process consists in the replacement of calcium and magnesium salts in water by the sodium base of zeolite or hydrated silicate of aluminum.

Ore Loaders—Lake Superior Loader Co., Duluth, Minn., has just issued an attractive loose-leaf booklet describing and illustrating the Shoveloder. In addition to an attractive arrangement of the illustrations and reading matter, an effective insert idea has been carried out which adds a good deal to the originality of the booklet. Interesting operative data, arranged in usable form, is given, time studies and tests are included, and the issue is replete with information that is valuable not only to those contemplating the purchase of such a machine but also to the man who has them in use.

Centrifugal Pumps — Allis-Chalmers Mfg. Co., Milwaukee, Wis., have just issued bulletin No. 1632-F, "Centrifugal Pumps and Centrifugal Pumping Units." The various types are described and a number of the services for which they have been used are given. Of particular interest to our readers will be the references to power plants, refineries and mines. In the latter, the centrifugal pump is unusually well adapted to the unwatering and drainage of mines, and many of the largest mines in this as well as in foreign countries are equipped with Allis-Chalmers pumps which operate against heads exceeding 1,000 ft.

Pressure Filters—Emil E. Lungwitz, 90 West St., New York City, has issued a 10-p. catalog describing the Haubold automatic centrifuge or self-unloading rotary pressure filter. This machine is said to be an improvement on the general types of centrifuges and also on leaf and rotary suction filters, due to its simplicity of installation, small floor space considering its capacity, minimum power consumption, the requirement of little labor and the delivery of a thoroughly washed and dried product. The Haubold centrifuge is built in two styles, either half automatic or absolutely automatic. The booklet concerns itself with the half automatic centrifuge solely. The machine will handle such materials as calcium carbonate, calcium sulphate, magnesia carbonate, barium sulphate, barium carbonate, alumina, cyanide slimes and flotation concentrates, which at present are handled by the various makes of leaf and rotary suction filters.